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# Electrical World

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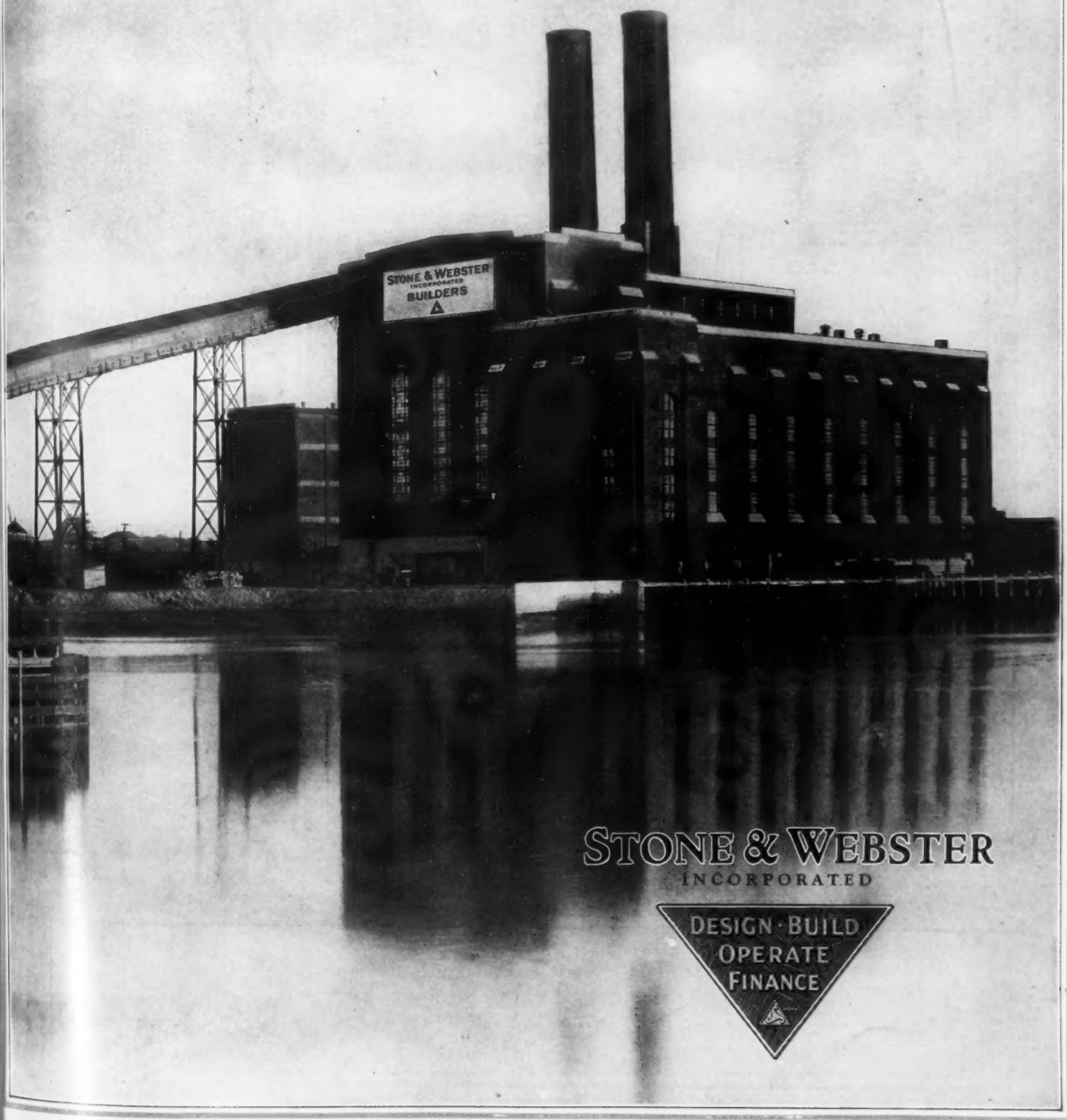


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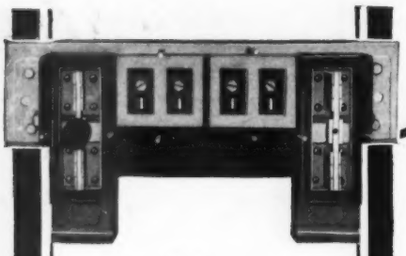
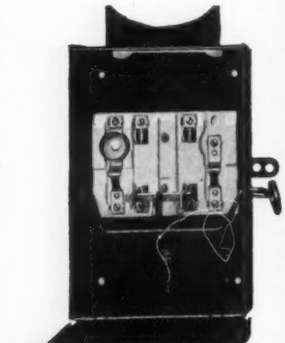
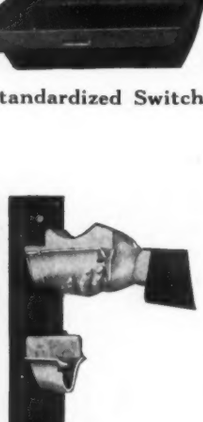


Subway
Sectionalizing Units



Standardized Switches



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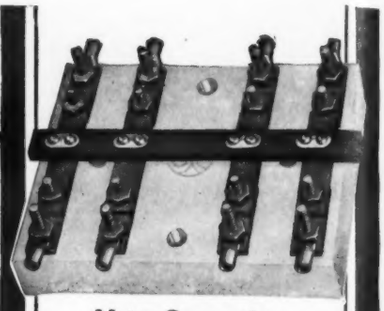
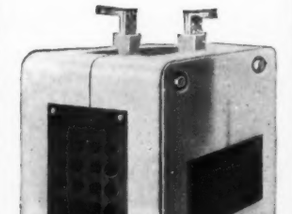
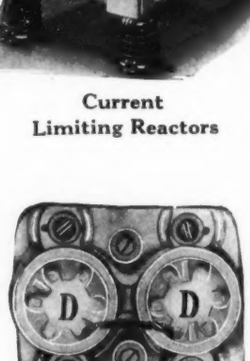


Meter Connection
Test Blocks



Current
Limiting Reactors

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# Electrical World

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## The Muscle Shoals Hydro-Electric Development

AS THE time approaches when the hydro-electric development at Muscle Shoals will be ready for operation the country finds the government without agreement as to its final disposition. Congress still debates, and the Senate is divided between two opinions —government ownership and operation and government ownership and private operation. The recent election, with its mandate against government ownership, has apparently left the Senate undisturbed. Moreover, the suggestion of the President that a commission dispose of the matter also goes unheeded. There is hope, however, that the House of Representatives, which is less inclined toward government ownership, will meet the issue squarely and ask for a commission.

The debate in the Senate during the past three weeks has revealed nothing except its lack of knowledge of technical matters and of the operation of hydro-electric properties. Congress is never at a greater disadvantage than in such matters.

Muscle Shoals was developed at tremendous cost as a war measure. No operator, much less the government, can operate the plant in competition with existing utilities and pay a return on the investment. The thought in the minds of some Senators that through government operation of Muscle Shoals the price of electricity throughout the South will be greatly cheapened is predicated on hope and not on fact. The station when it is completed will be simply a hydro-electric station, without market for its output, without transmission lines to distribute the energy, without even transformers to step up the voltage for transmission. It will be, in short, a monument to government folly and inefficiency. Operated as a public utility in conjunction with the other public utilities of the South, a market can be found for the energy and the benefits of Muscle Shoals spread over the entire Southeastern district. The government, however, will have to pocket a loss in the sale of the property or in its lease; but even at that it will recover more from Muscle Shoals than it did on the other war plants which went under the auctioneer's hammer.

## Postal Handicap on Industry Publications

THE proposal to increase the postage on second-class mail matter is a great menace to industry publications. These of necessity must be national in character and hence must employ the mails for distribution. No state or geographic section can support adequately an industry paper. Even national publications have only a limited circulation, but that circulation is vital to the life of the industry served and to the prosperity of the country.

A man engaged in any specialized business may go without his weekly story paper, he may even dispense with his daily newspaper; but he cannot long forego the perusal of his industry paper and survive in business. All progress, all discovery, all invention, all the experience of others in his calling, would be more or less a closed book to him without his industry publication. To increase the postage on such a periodical would work a hardship on those remote from the place of publication and in many instances destroy the paper itself. With their present service, no industry paper can support itself on subscriptions—the advertiser carries most of the burden. To load more of the cost on him might cause him to withdraw or to curtail his advertising, and while temporarily the Post Office might gain a little, in the end it would lose, because in choking industry it is throttling itself.

## Group Replaces Individual Research

MODERN man may not excel his ancestors in sheer native intellectual capacity, but he has developed a technique so superior that his intelligence enjoys enormous advantages. There now seems to be no practical limit to the changes which he can hope to bring about in the conditions of his life by the application of his technique to the forces of nature in a way to bring alterations for the enrichment of civilization.

Scientific evolution has developed a group technique as well as an individual technique. In the days of Watt, of Faraday, of Maxwell and of Thomson individual thinking, experimentation and enterprise were relied upon to bring scientific advances, and these giants built up a body of data and a volume of formalized knowledge which supplied the foundation for the engineering of modern days—the era when physical machinery and economic development came into conjunction to speed the work of the world.

The engineering profession was born of the necessity for co-ordinating action, recording accomplishment and determining programs. It represents group action and group thinking for constructive purposes. It has built a body of knowledge, a recognized status, a system of standards and an educational or experimental system whereby advances can be made logically and through the efforts of a group of workers. Nowadays an engineering achievement represents the work and thinking of a long line of scientific experimenters the last of whom has added the finishing touch. It does not spring full-fledged from the brain of an individual nor does it come about through experimental accident or mental fumbling.

The modern research laboratory and graduate school, together with the professional engineering societies, are the agencies whereby this group is motivated and rendered effective. They grew in answer to the needs of the situation, and their work is certain to bring

results more useful and even more spectacular than have come heretofore through the achievements of brilliant individual workers. These are more power, more technique and more potentiality to advance through co-ordinating work and workers in accordance with a definite plan. Every encouragement should be given to group scientific and engineering research in order quickly to realize the glowing opportunities as yet hidden in the depths of nature.

## Secondary Water Powers Afford Insurance Reserves

THE growth in size and extent of light and power systems introduces hazards to service and responsibilities for service that require appreciable investments in reserve equipment. Happily this reserve makes possible in many instances the use of fugitive waters which otherwise would waste away because of the impossibility of their economic development as self-contained sources of energy.

A very large system with steam stations has the capacity to absorb the floodwaters of streams having widely fluctuating flow and no storage possibilities. At low-water periods the steam capacity can supply the load satisfactorily with little reserve steam equipment, since the pools at the dams on streams can be completely emptied should a steam unit be taken out of service because of accident. This would give ample time to make interconnection with other systems or to start other steam equipment without causing any decrease in quality or quantity of service.

Thus the growth of interconnection and the increase in system areas afford means for utilizing great natural resources while at the same time necessitating a minimum over-all cost of insurance reserve for the systems.

## Scientific Mixing of Colors

REPORTS have been printed in these pages once or twice on recent developments in the old method of study of colors and their combinations by rapidly revolving colored sectored disks, whereby the eye receives a combined impression. A recent issue of the French magazine *Recherches et Inventions* contains a detailed description of a device, named the chromo-complemometer and developed by M. Fouilleul, that goes farther in this direction than anything attempted before. Each primary color is broken up into numerous shades, and to each shade is assigned a definite place on a sector. Thus, in matching a color it is possible to set various disks to a nicety, to add a required quantity of gray and to read the results on a scale. By a simple subtraction the exact complementary color of the one obtained can be also specified by numbers.

This development is a welcome one as tending to enhance the value of electrical illumination and its artistic effects. A device of this kind, with translucent sectors in front of a projection lamp, may be used to produce wonderful scenic or decorative effects, with a gradual change of hue or tint. The device should also find numerous uses in industries where color matching is of importance, as well as with artists and decorators and in schools where these subjects are taught. In its folly and ignorance humanity has produced many ugly greens and yellows. Atonement for them may be made in these modern days by exceeding Nature, with electricity's aid, in beautiful color production.

## Interconnection "in Being"

DURING the World War the mere existence of the Allied grand fleet, or the "fleet in being" as it was called in the parlance of strategics, was a mighty factor in the conduct of operations. Behind the booms of a great naval base the fighting ships weighed heavily upon enemy high command and exerted a pressure upon hostile activities that was none the less real because it was invisible. In like manner the completion of an interconnection between utilities may pay for itself in reduced fixed charges on generating-plant reserve even if months and perhaps years go by without the transmission of a single kilowatt-hour over the line. In a typical case the differences in diversity factor of the system loads may be so great that each plant may rely upon the other for reserve to an extent that will justify the construction of the tie line and the virtual abandonment of provision for new reserve capacity in the local stations. And so there may be "interconnection in being," with the result that allied service meets economic demands unforeseen a few years ago and proves a great public benefit even if the line is dead for weeks and months at a time.

## Much Ado About Nothing

SOME very valuable and constructive work has been done by joint committee action on electrolysis, inductive co-ordination, joint use of poles and other major questions which involve conflicting interests. The most important contribution of all is the spirit of co-operation and friendliness that has been produced and the mutual forbearance and understanding resulting from the interchange of opinions and views.

It is important that this spirit be sustained, but recent trends in several localities on several phases of joint committee activities seem to indicate danger of relapse into the antagonistic conditions of older days. Clashes of personality, positive opinions fixed by partisan debates and the natural insistence of engineers on precision result when attempts are made to regulate or specify too rigidly. Once the spirit of co-operation has been evidenced and joint committee action attained, it is inevitable that, with age, these committees will devote thought and time to details, with consequent loss of perspective and the development of antagonistic viewpoints on rigidly prescribed limitations.

It should be borne in mind that the technical and commercial aspects of the engineering art are continually changing and that no one can measure the future developments in equipment or practice. It is right and natural that representatives of different branches of the electrical industry should strive to protect their respective branches when detailed rules are proposed on controversial matters. No progress results, and the work of a committee becomes a hazard instead of an asset to industry.

What there should be on fundamental controversial questions is the spirit of co-operation, the mechanism for securing a working solution of each case that arises, and the formulation of very broad and fundamental principles and methods of procedure. If these things are done, action can be had on each specific case that will be satisfactory to all parties at issue. This accomplished, a joint committee, its work well accomplished, can disband.

### Use of Air-Break Switches for Alternating Current

WHEN direct current was the sole source of electrical energy for commercial purposes, air circuit breakers were developed which served very adequately the needs of industry and which even today in street-railway service give satisfactory performance. With the coming of alternating current and high voltage, oil circuit breakers were developed and soon became popular for all alternating-current service. During the war very great strides were made by oil circuit breakers for low-voltage alternating-current applications, owing to the great use of induction motors equipped with starting compensators.

There now seems to be a tendency toward a scientific determination of the economic engineering fields of application for oil and air circuit breakers, and studies are being made which should give data and not opinions upon which to predicate installations. Inherently it would seem easier to break an alternating-current arc than a direct-current arc of the same maximum voltage, but few real data on this point are available. There is no doubt, however, that air-break switches have a large economic field of application in the industrial and transmission divisions of alternating-current practice and possess certain advantages when compared with oil circuit breakers for many applications. It is a hopeful sign to observe studies to determine more completely the useful field of application of air-break switches, for these studies should result in better breakers of both types and give definite answers to debated questions.

### A Demonstration of Co-ordinated Advertising

AN INTERESTING demonstration has been made this Christmas of the possibilities for co-ordination in certain seasonal advertising by the electrical industry. Last spring the Society for Electrical Development suggested to the advertising managers of the more prominent electrical manufacturers who are members of the Advisory Publicity Council that the society produce a standard Christmas window display background and certain small "cut-outs" of holly wreaths and Santa Claus figures for use by any manufacturer in combination with his own individual window advertising features. The purpose was both to relieve the individual manufacturer of the heavy expense of developing his own window background and obtaining reproductions of these standardized and universally used Christmas symbols and to provide uniformity in the basic elements of electrical Christmas window displays. Such uniformity is considered of great importance because of the cumulative influence of repetition on the shopper at the time when electrical merchants are not so much in competition with each other as with the other shops that are dangling attractive gift offerings before the public eye.

Commitments were made last spring for more than five thousand of these window-trim backgrounds, and each manufacturer designed his additional individual elements to tune in with them. These displays were sold to the manufacturers and for the most part were resold by them at cost. The society also sold many sets direct to retailers. In more than five thousand electric stores, therefore, the message "Give something electrical" was flashed from the same supporting background. It is an excellent start toward a still further adoption of this kind of industry advertising wherever it is productive and economical. The selling of such seasonal window material is certainly a great improvement over the too common process of lavishly broadcasting expensive displays, a large proportion of which is utterly wasted.

### Load Factor Is Becoming a Real Issue

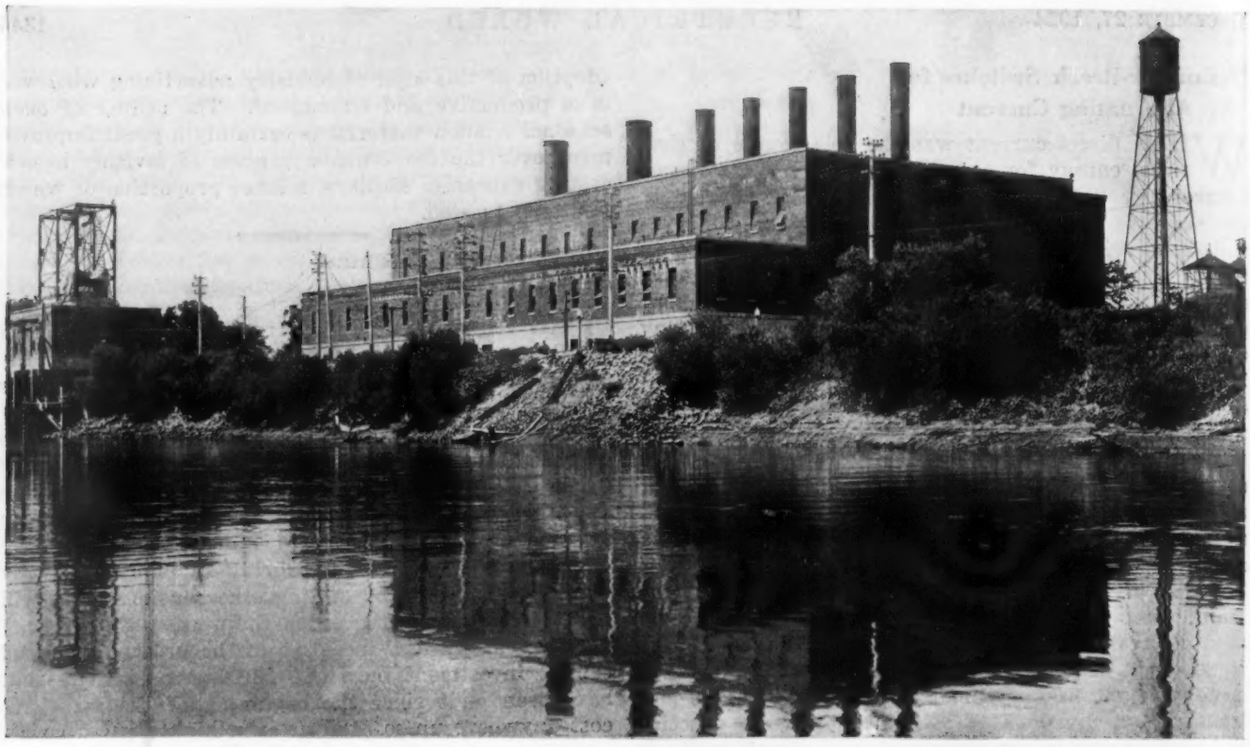
THE central-station industry has suffered through the years because of a general acceptance of the idea that the duty of a public service company compels it to take business as it comes without regard to its character. The fact that this perfectly proper attitude of readiness to serve does not restrict any company in the selective development of business has been too much overlooked. As a result, the load factor on many systems is not what it should be, and little real creative effort has been put forth to bring an improvement by actually going out and getting other business that will help fill the valley or broaden the peak.

Now comes a new incentive in the greatly increased capital investment burden. The steam stations that have been built since the beginning of the war have cost anywhere up to $125 or even higher per kilowatt capacity, whereas before that time $65 might have been a normal figure. The influence of this increased investment is beginning to be felt, and executives are asking themselves if something cannot be done. It is obvious that better load factor will express itself in higher earnings on this plant investment, which will have the effect of reducing the burden of station overhead proportionately. Therefore the need for more attention to the improvement of load factor, through the development of intelligently and purposefully selected markets, is fast becoming an issue in the industry. This is a good sign of a quickening economic consciousness from which great things may come.

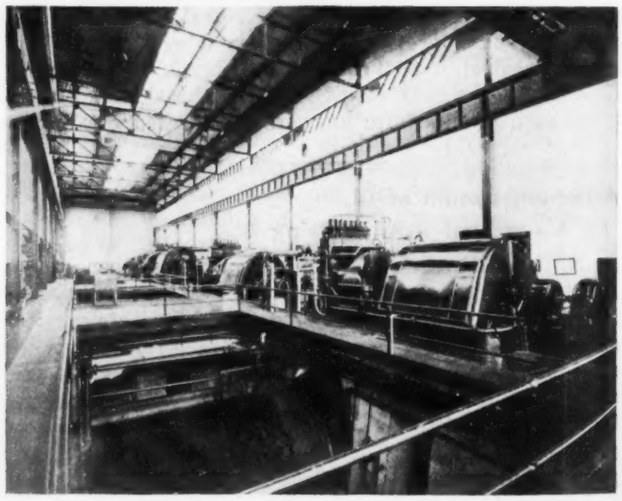
### Sitting in a Draft and Facing Glaring Light Sources

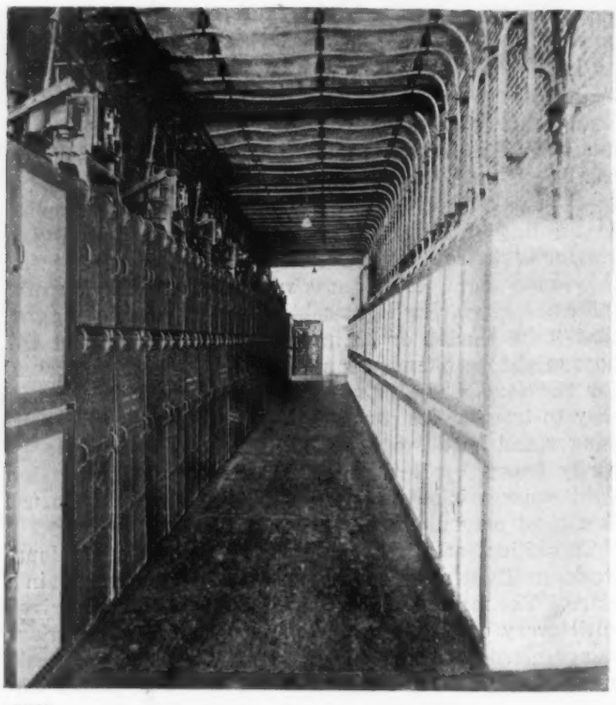
WHEN one finds himself sitting in a draft in somebody's office or in a friend's home, he does not hesitate to protect himself from this exposure. He may change his seat or may even ask that the draft be reduced or eliminated. This is a privilege which is recognized by both host and visitor and no offense is involved. Why should not the same principle be applied to lighting? How often one finds himself facing a glaring light source. Does he feel as free to mention this annoyance? Even those who recognize the harmful influence of glaring light seldom find it easy to suggest that it be shaded or extinguished. It is felt that the host might be offended, and, doubtless, there is ground for the fear. The effect of exposure to a draft is so easy to trace to its cause that every one recognizes the danger and hosts would not suffer guests to be unnecessarily exposed. But the effect of exposure to glaring light sources is so indirectly associated with the cause that most persons do not recognize the evil.

This illustrates very well the need for educational work in lighting—for a continual campaign against glare. The millennium in lighting will not have arrived until every one feels as free to complain against glare as against drafts. To bring this about is no small task, but constant, tactful agitation whenever a proper opportunity presents itself will eventually change the attitude of the public mind.



# Largest Generating Station in Oklahoma





ENLARGEMENT of the Oklahoma Power Company's generating station near Tulsa is about completed and will make available to the Public Service Company of Oklahoma—the distributing company—30,000 kw. This is reported to be the largest station in Oklahoma. Fuel oil will be burned, but provision can be made for burning coal quite easily if oil becomes scarce or too expensive, inasmuch as track facilities for bringing in coal and taking out ashes are already provided. About 15,000 bbl. to 20,000 bbl. of fuel oil will be burned per month. To tide over interrupted deliveries three storage tanks are provided with a total capacity of 79,000 bbl. To facilitate the flow of the oil, it is initially heated to 100 deg. F. and then heated to 140 deg. in an auxiliary tank before burning, and finally to 180 deg. in a pressure tank. Eight boilers are installed, the latest additions being rated at 1,000 hp. each. Space is provided for two more. Steam is generated at 250 lb. pressure and 600 deg. total temperature, de-aërators being used to prevent pitting of boiler tubes. About 70,000,000 gal. of water is used in a day. The generators are rated at 13,200 volts and energize five outgoing circuits, two of which pass under the Arkansas River.

Major J. H. Buell, vice-president and manager of production of the Oklahoma Power Company, has been in charge of the enlargement of the plant.

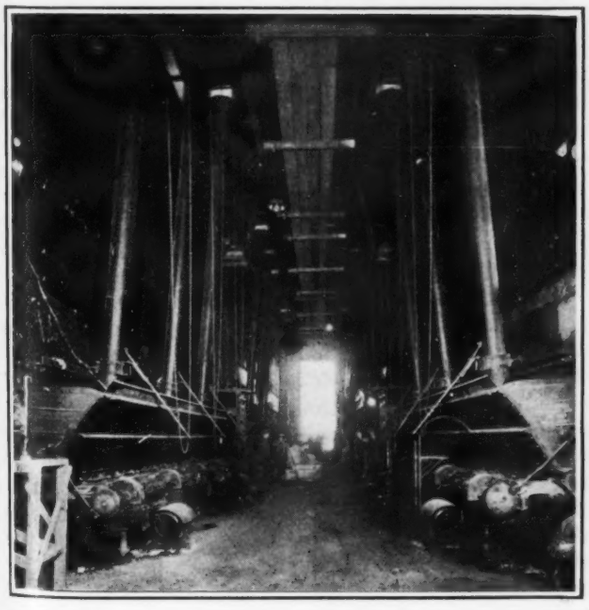
# Completing High Bridge Plant at St. Paul

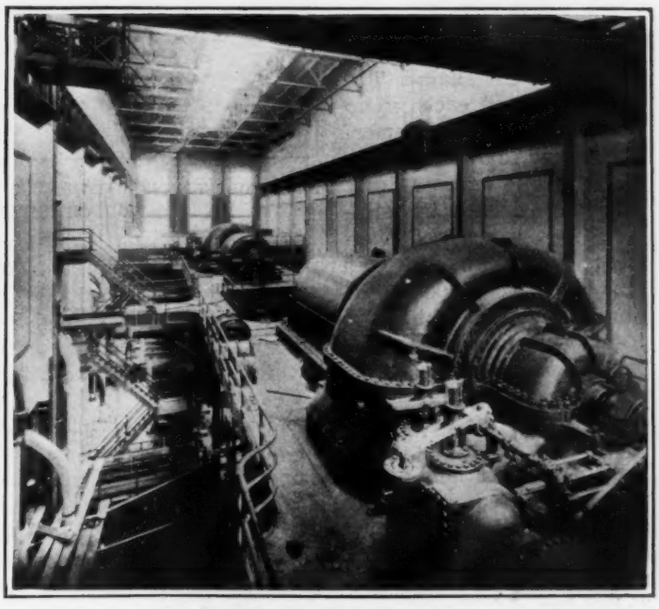
## Economy of Operation Balanced Against Fixed Charges and Design with Due Regard to Simplicity and Convenience of Operation — No Radical Departure from Established Practice

NEW HIGH BRIDGE STATION OF NORTHERN STATES POWER COMPANY

THE first two-unit section of the High Bridge generating station of the Northern States Power Company on the Mississippi River between St. Paul and West St. Paul, which will serve as a base-load plant to supplement the nearby water powers, is being completed. No radical departures have been made, economy of operation being balanced against the fixed charges in the design with due regard to simplicity and convenience of operation. It was decided that the higher cost of providing for the use of pulverized fuel would offset its higher efficiency and flexibility, and for this reason underfeed stokers were used. Two-stage bleeding of turbines, with a fair proportion of steam and dual drives for auxiliaries, has been chosen to insure feed water in excess of 200 deg. at any load. Owing to the silt and sewage in the river, evaporators are being used for boiler make-up water. Because of the multiplicity of stations tied together by a high-tension loop, around St. Paul and Minneapolis, no duplication in auxiliaries has been provided. Economizers, air preheaters and house turbines were omitted from the plan after careful consideration.

Illinois, Indiana or Eastern coals—the latter received by the Great Lakes water route—can be used in this station, the kind selected at any time depending on the number of B.t.u.'s which can be obtained per dollar. At present this basis of comparison favors Eastern coal. Between Duluth (the lake port) and St. Paul the coal will have to be transported by rail, of course, and double unloading tracks, housed because of the extreme temperatures in winter, with six hoppers per track, will be used for unloading and the coal will be transported to the crushers and bunkers by belt conveyors and





AT LEFT, BOILER ROOM AISLE. AT RIGHT, TWO 30,000-KW. TURBINES IN INITIAL STATION

bucket conveyors. Coal will be handled in open storage, which will accommodate 170,000 tons, by locomotive cranes.

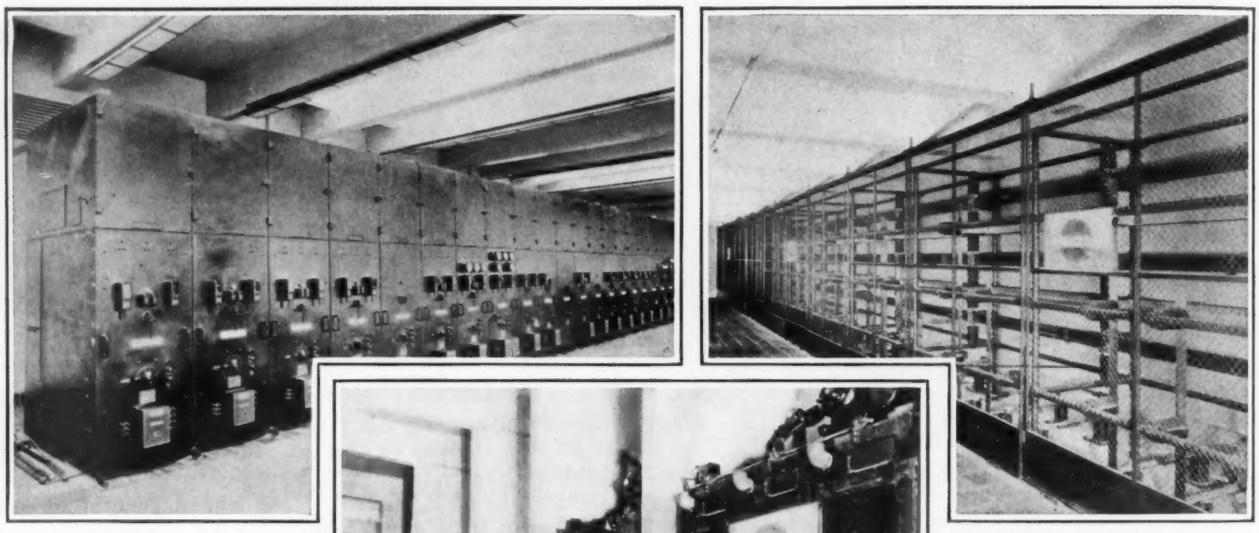
### BOILER EQUIPMENT

Steel-cased boilers to operate at 300 lb. pressure and 672 deg. F. will be installed on each side of firing aisles with bunkers over each aisle. The boilers will be of the double-deck type (six tubes high in the lower deck and twelve tubes high in the higher deck) with a total heating surface of 18,750 sq.ft. A large percentage of the lower tubes will be exposed to radiant heat. The furnace will have a volume of 5,300 cu.ft., or 2.8 cu.ft. per 10 sq.ft. of heating surface. A radiant superheater will be installed in the bridge wall of each furnace and a convection-type superheater above the tubes between the first and second passes. This combination is provided to assure a more uniform superheat with varying load. The underfeed stokers with clinker grinders will be divided into two sections, each driven by multi-speed induction motors through silent chains. The two halves of each group can be coupled in an emergency and driven by one motor. The forced-draft fans are driven by slip-ring motors. Hand control is provided at each boiler panel for two stokers, two fans and two clinker grinders. The air-supply ducts can be cross-connected in an emergency. Brick-lined 40-ton ash pits are provided under each furnace with pneumatically controlled gates which discharge directly into railroad cars.

Instead of the usual steam-header system, this plant is equipped with manifolds just long enough to accommodate connections. Motor-operated sectionalizing valves are used. The turbines are of the seventeen-stage Curtis type, guaranteed to operate with a water rate of 9.6 lb. per kilowatt-hour at the most efficient rating, namely, 27,000 kw. These prime movers drive 35,300-kva., 13,200-volt generators, which have separate exciters with dual drive and a closed system of ventilation with space for air washers under the generators.

Since there is a difference of 20 ft. between the high-water and low-water elevation of the Mississippi River at this point, pits have been excavated to low-water elevation for the condensers, which are of the vertical-surface type. The condenser auxiliaries, boiler-feed and service pumps are also accommodated in the pit and served by either the turbine-room crane or an auxiliary crane. These pits are lined with white glazed tile.

The basement floor is really the main floor of the generating plant, the units being placed on island foundations with merely walkways around them. These arrangements make all piping accessible, avoid heat concentration and facilitate ventilation and illumination of the plant.



2,300-VOLT TRUCK BOARD, 15,000-VOLT BUSES AND TRUCK-TYPE OIL CIRCUIT BREAKERS

Condensate from the condensers is pumped through the feed-water evaporator condenser, two bleeder heaters (taking steam from the eleventh and fourteenth stages of the main turbine), an open heater and a weigher to the boiler. The circulating-water intake and discharge constitutes one part of the plant and has been laid out for the first half of the ultimate installation, which will probably be eight units. Provision is made for recirculating the water in winter to prevent frazil ice accumulating on the trash racks. Each condenser contains 44,000 sq.ft. of cooling surface and is equipped with a single circulating pump with dual drive.

The switch house, which is also laid out for one-half of the ultimate installation, has six floors—the first containing the outgoing cables, the second housing the feeder reactors, potential transformers and automatic starters for exciters; the third accommodating the control conduits, the fourth the oil circuit breakers, the fifth the main and auxiliary 13,200-volt buses, and the sixth floor the bus reactors and bus-tie breakers. One feature of the electrical part of the plant is the use of copper bars from the generators to the buses and from the buses to the cable end bells, supported in such a way that they will be accessible at all points. No high-

voltage cable is used inside the station. Truck-type circuit breakers are used extensively and are interlocked with disconnecting switches, which are gang-operated. Double sectionalized buses with reactors between each two sections are used, with one generator per bus section.

Auxiliary power to the extent of 3,500 kw. connected load is supplied from the main buses through either of two transformer banks. Motors rated at 75 hp. or more operate at 2,300 volts, the smaller ones at 220 volts.

This station was designed by the Byllesby Engineering & Management Corporation, of which H. W. Fuller is vice-president and chief engineer, F. H. Lane manager of engineering and construction, H. Boyd Brydon mechanical engineer, and R. M. Stanley electrical engineer.

James Colvin is superintendent of generation of the Northern States Power Company, which is under the Byllesby management.

# Line Construction Cost Keeping

## Simplified Records Determine Continuous Status of Work Under Progress—Foremen's Reports Constitute the Basis for the Accounting System Followed by the Auditor Serving with the Force in the Field

By F. H. MILLER* and F. W. FACKLE†
*Hoosier Engineering Company, Indianapolis, Ind.*

A SIMPLE system of cost keeping whereby transmission-line erection costs are kept posted during construction for weekly comparisons of expenditures has been devised by the Hoosier Engineering Company. This system applies to erection costs only, as these costs are the variables in which this company is primarily interested under different construction conditions. Unless these costs are closely watched, a very considerable amount of money can be uselessly expended on a large construction job. Although a record of costs at the completion of a job proves very interesting and valuable, it is far more important to know exactly during the process of the job what it is costing at any given period.

This knowledge is of special value to both the transmission-line contractor and the customer. It allows for a timely application of correcting and economizing remedies. To know detail costs, it is necessary that a close accounting be made on each of the subdivisions making up a major operation. Thus, on a wooden-pole transmission line knowledge must be obtained as to the cost of unloading, framing, distributing to a point where it can be erected, digging the hole and erecting each pole. This itemization of the various phases of a major operation is accomplished by the foreman listing the time of his men under operation symbols, standardized for all the company jobs. In this code the symbol "A" designates unloading, storing and distributing materials. The other symbols are given in Fig. 1.

### FOREMAN'S REPORT

The entire system revolves around the reports of the foremen of the operating crews. Each foreman does his own timekeeping, makes his own payroll, pays his men and all miscellaneous expenses. These reports are obtained from daily and weekly time slips with perforated detachable sheets, arranged in pad form (Fig. 1). This time pad is of pocket size. By having the workmen's name and rates entered during the first part of the week much time on the foreman's part is not required to assign the proper code letters and hour's work at any convenient period of the day, since in general men work on one operation throughout the day. All the miscellaneous expenditures are charged to the job number plus the operation symbol.

HOOSIER ENGINEERING CO. TIME CARD

JOB 971 LOCATION — City WEEK ENDING 9-11-24

| DATE | OPERATION | HOURS | RATE | AMOUNT | ✓ | REMARKS |
|---|---|---|---|---|---|---|
| 9-5 | B | 10 | 45 | | | |
| -6 | A-M | 10 | | | | Cross arms |
| -8 | " | 5 | | | | |
| -8 | B | 5 | | | | |
| -9 | " | 10 | | | | |
| -10 | " | 10 | | | | |
| -11 | A-M | 10 | | | | Insulators |

WORKMAN W. Kennedy TOTAL AMOUNT $ 27.— HOURS 60

Form F-1580-A-21 FOREMAN OR CUSTOMER'S O. K. E. A. Jones

| OPERATION NO. | DESCRIPTION OF WORK | | |
|---|---|---|---|
| A | Unloading and Distributing Materials | G | Erecting Insulators and Stringing Wires |
| B | Digging Holes, Raising and Tamping | H | Tree Trimming or Clearing |
| C | Surveying | I | Substation Erection |
| D | Framing | J | Traveling Time |
| E | Assembling and Erecting Cross Arms | K | Hanging Transformers |
| F | Erecting Anchors and Guys | L | Concreting Structures |
| M | | | |
| N | | | |
| O | | | |
| P | | | |
| R | | | |
| S | | | |
| T | | | |

Any work not covered by above, note under extra letters.

FIG. 1—INDIVIDUAL DAILY AND WEEKLY TIME SLIPS FILLED OUT BY FOREMAN

At the end of the week it is a simple matter for the foreman to total the time of every workman entered on his payroll, make out a time slip for each truck, indicating the days used, and thus make up a complete report of his weekly expenses on a form (Fig. 2). Since the payroll week ends on Thursday and the men are paid on Saturday, this report is forwarded to the field office on Thursday night or Friday morning. The field auditor immediately audits the resports, and if correct, the total amount shown therein for each foreman working on a particular job is wired to the home office. The home office then deposits these amounts under the various foremen's checking accounts in the home office bank. All the foremen's disbursements are made by check drawn on this special bank account. Their bank accounts are operated on the usual im-

*Vice-president. †C. P. A. auditor.

HOOSIER ENGINEERING CO
INDIANAPOLIS IND

Job No. 971 Location City Expense Week End 9-11-24.

| MATERIAL PURCHASED | AMOUNT | CHARGE | REMARKS |
|---|---|---|---|
| C. R. Smith Auto Co | 28.90 | T. & G. | check # 4801 |
| Burroughs Garage | 18.70 | " | " 4802 |
| Amer. Hdw. Co | 24.50 | Tools | " 4803 |
| TOTAL | 72.10 | | |

Foreman E. A. Jones

NOTE—Make Separate Sheet For Each Job. Attach Receipts. Fill Out Other Side.

| | | | |
|---|---|---|---|
| Total Labor | $ 491.— | Advance | $ |
| T & G | 47.60 | Less Above | |
| Tools | 24.50 | Balance | |
| Frt. & Dray | | Check | |
| Board | | Advance | |
| Supervision | | | |
| Material | | | |

Total 563.10

Mail next week to Cave City, Box 312

Remarks:

FIG. 2—FOREMAN'S SUMMARY SHEET LISTING THE COMPLETE EXPENDITURES FOR HIS CREW

pressed cash-fund principle, thereby maintaining a constant balance in the bank to their credit. By this means the cash tied up in the various foremen's accounts is keep at a minimum.

For the purpose of further close study on individual truck operations, and also as a check on the purchases of drivers, another form (Fig. 3) is provided in pad form. This is available in pocket size, having aluminum binders. It is valuable as a check in settling weekly charge accounts. From the information sent to the auditor, workmen's time, rates, amounts and other required information are transferred to a summary sheet, as in Fig. 4. This summary sheet shows the labor subdivided into the different operations and is a basis for the billing as well as proper cost analysis. With this progress report it is thus a comparatively simple matter to determine the cost for that week per unit of operation.

During work justifying the unit system the foremen and men particularly trained for a particular operation are assigned to that operation, generally carrying it out to completion. On one recent job, where an exceptionally long and wide right-of-way was cleared through rough country, densely timbered, the clearing work was in charge of an experienced foreman, who selected his own crew from practiced woodsmen. A foreman placed in charge of setting poles had also previously demonstrated his ability through the use of his own picked crew, trained in his methods and teamwork. During the progress of the work they did scarcely anything but set poles. The labor of maintaining the unit cost system was by this means very much simplified. With each foreman undertaking virtually only one operation at a time and having certain trucks assigned for his own use exclusively, the timekeeping and reports were reduced to a minimum. On smaller jobs, however, where one foreman is in charge of several operations, he has only the additional duty of assigning code letters for the various operations at necessary intervals.

The field auditor by compiling from the foreman's report a totalizing progress and cost report shows the progress and cost to date on operation. The total cost of each operation and number of units completed for each week and for the job as far as it has gone is then available. From these data the cost per unit of material is determined for each week, as well as the average cost per unit to date; also the total cost of the job to date. Comparisons are then made with the estimated cost and previous cost so that any increases

HOOSIER ENGINEERING CO.
INDIAN POLIS, INDIANA
VOUCHER

Customer
Job Location
Week ending Sept. 11th 1924
No. 152

Job No. 971
Serial No.
Billed
Invoice No.
E. A. Jones account

| NAME | RATE | A | B* | B-B | E | A-M | G |
|---|---|---|---|---|---|---|---|
| N. Phelps | 40 | | 30-8.— | 30-8.— | | 30-8.— | |
| S. Capps | 35 | | 30-10.50 | | | 30-10.50 | |
| W. Smith | 45 | | 10-4.50 | | | 50-22.50 | |
| H. Conway | 40 | | | 30-12.— | | 30-12.— | |
| J. F. Caverly | 50 | | 60-30.— | | | | |
| J. B. Blair | 40 | | 30-12.— | | | 30-12.— | |
| | | | 109.— | 42.— | | 210.— | |

| | | | |
|---|---|---|---|
| Total Labor | $ 491.— | Cash Advance | $ 400.— |
| Truck Rental | | Paid Out | 563.10 |
| T. & G. | 47.60 | Bank Balance | — 163.10 |
| Tools | 24.50 | Deposited in Bank | 563.10 |
| Materials | | Balance in Bank | $ 400.— |
| Board | | | |
| Sundries | | For Balance of Expense See Jobs No. | |
| | | 973 & 974 | |
| Total | $ 563.10 | | |

Form 20—136-6-24

Bought of Burroughs Garage 9-9 1924
HOOSIER ENGINEERING CO.
By J. B. Blair

Truck No. 21

| | | |
|---|---|---|
| 5 | GALLONS GASOLINE | 1 10 |
| 1 | QUARTS OIL | 25 |
| | REPAIRS AND PARTS | |
| | TIRES AND TUBES | |
| | TOTAL | 1 35 |

Received Payment Burroughs Garage 9-11-24

FIG. 3 (ABOVE)—FORM FOR DETERMINING COSTS ON INDIVIDUAL TRUCKS.

FIG. 4 (AT LEFT) — COMPLETE REPORT OF EXPENDITURES MADE OUT BY FIELD AUDITOR FROM FOREMAN'S REPORT AND TIME SLIPS.

Expenditure billings are written directly from these forms

can be intelligently investigated and corrected before the work has proceeded too far. Each foreman is notified of the status of his weekly report, thereby affording him a means of knowing how efficiently he is operating.

### System Advantages

As any contractor's success is built on the good will of his clientèle, he realizes that, whether or not the work is being done on a cost-plus or a contract basis, it is to his own advantage to do the work under either condition as cheaply as possible and still observe good construction. To the customer, on the other hand, having his work done on a cost-plus basis a combination of a weekly cost and progress report is highly desirable. In the event of a flat-price basis the customer is still very much interested in progress. The contractor is also interested in the cost of construction. On all cost-plus work the customer has full access to the company's books of accounts and cost study on the work. Periodical billing as far as possible is so done that one invoice covers the cost of a major operation for the period. In this way the customer can very easily check the invoice against original cost entries.

The experience with the use of this system has proved well worth the additional clerical expense because of the saving to the customer and the establishment of a mutual relationship of good will and confidence between the contractor and the client. The only objection to the system which might appear at first would be the possibility with such a large organization of men (300) of requiring the services of an accountant. However, it has been found that one capable man can keep the costs up to date and also perform the many other clerical duties of a field auditor. If the work done is too small to warrant a field office, the data are obtained directly from the foremen's reports at the home office.

# Illumination Opportunities

## Faults and Fallacies in Use of Illumination by a Large Part of the Public—Examples of Loss Through Poor Lighting—Good Light More than Pays for Itself—Opportunity for Lighting Industry

By NORMAN MACBETH
*Macbeth Daylighting Company, New York, N. Y.*

WHY is it that the cost of lighting service is so overcapitalized—considered so frequently as an extravagance and high-priced luxury? If money is to be saved, "Turn off the light" and "Use smaller lamps" are two standardized slogans of many years' standing. "How can I save money on my lighting?" has been the subject of many more investigations than have been devoted to "How can better lighting be made to make money for me?" These are questions of deep concern to the entire lighting and electrical industries.

As a result of many years' observation, the writer cannot recall an instance of money saved by reducing expenditures for lighting that really amounted to anything in dollars and did not indirectly cost a great deal more than was saved in the reduced cost of energy. Lighting must be sold more and more on the basis of what it can accomplish.

Illumination, the effect of light, is a means to an end. Through overemphasis on cost of light attention is diverted from the mistakes resulting from reducing its quantity. The general slowing up of work in shops from eyestrain and inability to see when the intensities are only sufficient to render obstructions in the shop visible as a means to prevent accidents is overlooked, as is the impossibility of displaying goods properly in stores when the light is just enough to enable customers to avoid bumping into counters and aisle obstructions. In poorly lighted stores, moreover, goods have frequently to be taken to the door to see what they are like—whether the fabric is woven or pressed and what the exact shade is—and no account is made of the lost time of the clerk waiting at the counter for the customer's return.

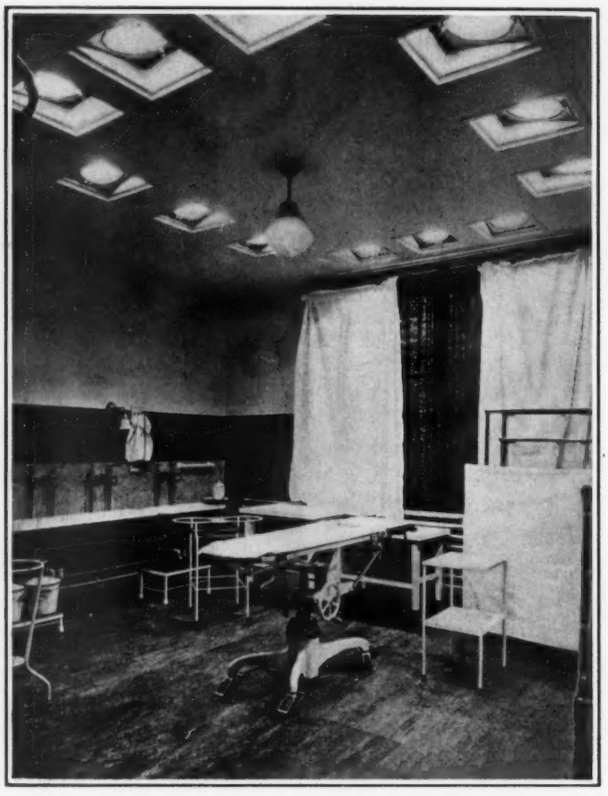
There is scarcely a store in which customers do not lose hours of their time because they cannot see quickly, clearly and easily what they are about to purchase. As a direct result of inadequate lighting many thousands of dollars in losses are taken in returned merchandise, lost sales time, double deliveries, "take-it-out-and-bring-it-back" charges, wear and tear of merchandise, piece goods sent to the remnant counter and similar ways because store lighting is in intensities employed nearly down to par with the average street lighting.

### Saving in Light Is a Negligible One

In the department store the average lighting charge is quite similar to the cost for wrapping paper and twine used in tying up the customers' purchases. As a matter of fact, in most stores, according to a survey by the United States Chamber of Commerce,* the cost for "light, heat and power," including in some instances "deliveries" and "water," is from three-tenths to seven-tenths of 1 per cent of net sales. An analysis made in a department store of the proportionate appeal to the senses in effecting sales resulted as follows: Taste, 1 per cent; touch, 1½ per cent; smell, 3½ per cent; sound, 7 per cent, and sight, 87 per cent. With sound 7 per cent and sight 87 per cent just consider what good lighting is worth. It is about true that "A look is worth a thousand words."

In the shop the lighting cost is usually a fraction of the cost for porter service in keeping the floor clean. One per cent of the wages of a mechanic only one step in earning capacity above a common laborer will buy a great deal more light than that mechanic ordinarily uses. This 1 per cent expenditure need result only in rendering each workman's time more productive by five minutes in an eight-hour day to offset the

**Retail Ledger*, October 1, 1924.



TWELVE KILOWATTS ARE USED IN DAYLIGHTING THIS OPERATING ROOM IN A BOSTON HOSPITAL; THE COST OF ENERGY IS ABOUT EQUAL TO THE COST OF THE ETHER USED; RESULTS JUSTIFY IT

electrical charge in the light expense account with a profit credit in the production account.

In the home the family can go to bed with the chickens and get up after sunrise and be enabled thereby to save the entire cost of light. The result would probably be enough additional money to afford cream in the family coffee for breakfast; or if black coffee were preferred, then there would be sufficient cream to wet, but not to float, one shredded-wheat biscuit each morning for a month as a reward for the fortunate member of the family who conceived the brilliant plan of economy.

To go without light in an office will save enough money for iced spring-water service or towel service, either of which is an average comparable cost. A dark room in an office building, which without artificial light is useful only for storage purposes, can be made available for office use at an expense for electricity of approximately 3 per cent of the rental, thus showing an excellent profit to the landlord if he furnishes light and puts the room on an office basis as regards rent, or to the tenant if he is fortunate enough to acquire dark office space on a storage rental basis.

We ruin our children's eyes in the schoolroom through inadequate lighting. If the money paid in after years to oculists and opticians could be made available for the few years of a child's school days, what a quantity of light it would purchase! A reduction of one-tenth in the expenditure for overheating schoolrooms would be ample to light these rooms properly without any increase in the total expenditure for "light and heat."

It is often not objectionable, even in rooms that are not overheated, to reduce the temperature slightly, as cool rooms can be borne without discomfort if proper clothing is worn, but nothing that the parent can supply will compensate for inadequate lighting.

In a recent copy of a business publication† whose editors select for their "reader-circulation of 736,000 and more" the reports from other business men of "exactly how they have reduced the expense of carrying out the various functions which are common to every size and kind of business" space was given to the statement of a superintendent of how "lowering our ceiling drop lights 1½ ft. and then placing a white, varnish-coated piece of glass above the globes saved enough electricity in a month to more than pay the cost of the change." A clerk was rewarded for this idea, which, of course, also included the use of globes of lesser wattage. Here is an important business publication of recognized standing with this item on "How to save electricity" and not a line on "How to save human effort," or "How to do work better under adequate artificial light," or "How to make a nickel spent for electricity make a dollar in sales turnover"!

When labor is paid for eight hours' work, that work may be broadly divided into two general divisions—productive and non-productive. Adequate light does not necessarily stimulate the workman to greater effort, requiring a greater expenditure of his energy and thus taking more out of him. It merely transfers more of his time from the non-productive to the productive column. Increased production is just another term for prevented wasted effort. Labor waste runs into "big money" faster than any other kind of waste.

### DAYLIGHT AND ARTIFICIAL LIGHT

The idea of following nature's lead in lighting presents a somewhat advanced point of view that is in many instances worthy of consideration. Industrial plants are built with an aim to good daylight distribution, extensive windows, one-story sawtooth construction with northern exposure, etc. This kind of lighting is invariably worth while. The fallacy that "daylight costs you nothing" is being seriously questioned. The actual cost of daylight, when all the costs are consid-

†*System*, August, 1924.

THE TIE SHOP, WHERE A DAYLIGHT LAMP EARNED MORE THAN TWO HUNDRED DOLLARS IN THREE DAYS

ered, is usually more than for satisfactory artificial light, and the fact that daylight affords no protection against dark days and the early-setting sun of winter, and, of course, leaves night work unprovided for, results in a relatively higher total cost than if artificial light were on a basis to be sufficient and daylight were taken merely for good measure. The higher intensity of daylight in June is accepted as good measure over a clear day in January, with an intensity reduction of one-half to two-thirds in maximum and appreciably shorter hours between sunrise and sunset.

Indoor daylight as considered for working purposes has three main qualities—distribution, intensity or quantity, and color.

The distribution of artificial light is easily controlled, and its use from this standpoint is well understood. Diffusion and uniformity can be readily obtained. When dealing with intensities comparable with daylight, however, more than ordinary care must be exercised with lamps and reflecting media, or the results of excessive glare may largely defeat the main purpose—assisting vision. Under a source of glare which will result in a reduction of the normal pupillary diameter of the eye by one-half, 20 foot-candles is not so good as 6 foot-candles with the eye at normal aperture. With glassware sufficiently dense to show a lumen loss of even 70 per cent, a 30 per cent utilization would result in improved vision over bare lamps and illumination on a foot-candle meter of 100 per cent of the light generated, or over a C.R.I. globe having a so-called efficiency of 94 per cent. Intensity is an important factor in daylight. At windows and in many interiors where proper intensities are available there is probably ten and maybe one hundred times the light thought to be sufficient a year or two ago with artificial illumination.

With daylight we have a white light tending toward a bluish cast depending upon the exposure, where with artificial light the color is predominantly in the orange-yellow. Reproduced daylight—that is, an artificial light corrected with colored glass filters to result in a light which is similar in its visual effect to good daylight—is gaining a constantly widening recognition from executives employing high-priced labor on work that is exacting as to continued correct vision—particularly where color is a factor.

The writer was informed recently of an emergency operation at night in a hospital operating room of which his informant said: "I was convinced that the patient's life was lost because the surgeon couldn't see under artificial light what he should have seen and what he could easily have seen in daylight, and the worst of it was he didn't know he was not seeing under the ordinary artificial light." Can one value the saving in cost of light in an operating room which results in the loss of a life, when adequately reproduced daylight can be furnished there at a cost for energy of less than a dollar per hour of use—a cost about equivalent to that for the ether administered to the patient during the operation?

A grinding-wheel manufacturer was losing thousands of dollars a year through improper inspection under artificial light. The inspectors were unable to see qualities indicated by colors that were largely invisible under ordinary artificial light but readily perceived in daylight. The value of daylight in this plant was such that twenty times the previous electrical charges would be considered a relatively small item if the rejected work could be reduced by 1 per cent. With a reproduced daylight installation the "rejects" were actually reduced more than 50 per cent.

EIGHTEEN COLOR-IDENTIFICATION LAMPS ARE ABOVE THE COUNTERS IN THIS PIECE GOODS DEPARTMENT. EACH LAMP USES A STANDARD 500-WATT TYPE C BULB

A sheet-metal printer in one instance lost the time and material for more than 780,000 talcum cans on which the color went wrong because some of the work was done under ordinary artificial light.

A lithographer was refused acceptance for a million calendars with a trade-marked design because the color, which appeared similar to the approved copy sheet under artificial light, was quite different and unsatisfactory in daylight. These calendars were reduced in value to their weight in scrap paper.

A hat manufacturer was unable to use 1,800 dozen hat bands dyed to match his hats, which, though an acceptable match in daylight, were in violent contrast under artificial light. This error was due to failure to appreciate the importance of checking the color of these hat bands under both artificial light and daylight.

A textile manufacturer had a quantity of cut fabric turned back on his hands by a shoe manufacturer as the dye used in the cloth, while it matched the leather under daylight, was far from harmonizing with it under artificial light.

A small neckwear shop had accumulated a stock of several hundred dollars' worth of stickers, all of good-quality silk and good color in daylight, which could not be moved at one-third the regular prices in the ordinary artificial light of the store. Higher intensities were tried, as were also the blue-bulb "daylight lamps." These ties, under a lamp furnishing a reproduced daylight with a single 150-watt clear-glass bulb, properly corrected as to color, were sold at their regular prices in less than three days. The lamp thus earned more than $200 in three days, and its total cost was actually covered by part of the profit made by it in two days.

A silk buyer in a prominent New York store told the writer several years ago that a customer had no right to purchase materials in which color was a factor except between 11 a.m. and 2 p.m. on a clear day when color observation could be depended upon at the front door or out on the sidewalk. During the past five years color sales have been made in this store at all hours of the day on stormy as well as clear days and without going to a door or window. Convenient, accurate reproduced daylight extended the shopping hours from three hours on one hundred days a year to eight hours on three hundred days at an expense of under $1 per day for the entire silk department.

A lady recently purchased a white brocaded silk in a prominent New York store and had to go to another store, reputed to be one of the most dependable in New York, to obtain a plain white to match it. The match was made under natural daylight at a window about half a city block from the silk counter. Afterward $80 worth of silk, two remnants, were returned to these stores for credit because under artificial light one appeared pink and the other cream.

### SELL LIGHTING ON BASIS OF WHAT IT DOES—NOT KILOWATT-HOURS

What is the right kind of lighting service worth that will stop these losses? All these concerns undoubtedly watch their expenditures for light more closely than their expenditures for non-productive labor, spoilage, clerk hire, sampling, returned goods, etc., and actually saves cents on lighting cost against dimes and dollars lost directly through improper lighting. Notwithstanding these every-day occurrences illustrating the high cost of "minus light," the campaign to save on the alleged high cost of lighting keeps up, and the worst of it is that the electrical man is frequently the last one, and the most difficult, to convince that high wattage with effective intensities should be considered from the standpoint of merchandise turnover and not just kilowatt-hours. Where color is a factor, he can rarely see beyond a blue bulb which has been called a "daylight" lamp and "a close approximation to north-sky daylight." These terms so applied have no technical claim to accuracy, but are probably licensed as commercial expedients fitted to the educational standards of the trade.

Regarded as an approximation, the light from the blue bulb is almost as close to the light from the old carbon-filament lamp as it is to daylight. On the color temperature scale the light from a blue bulb, if we overlook its excess in green, falls less than two-thirds up between zero and daylight, while the carbon-filament equivalent temperature is registered at more than one-third the distance. The daylight referred to is not the north-blue-sky daylight of the color worker, but the ordinary kind, free from direct sunlight, which is satisfactorily used for the more casual color-identification observations by the mass of store customers.

# Duquesne Light Company Trains Engineers

## College Graduates Spend Year in Company Departments—Outline of Course and Results Accomplished—A Typical Class

BY R. L. KIRK

Assistant to Vice-President Duquesne Light Company, Pittsburgh, Pa.

IN ORGANIZATIONS expanding as rapidly as are the public utility companies it is of first importance to obtain technically trained men to fill the ever-increasing gaps caused by this tremendous growth. An excellent policy is to attempt to fill these openings by promotions of the more experienced and deserving employees to positions of increased responsibility and to fill their vacancies with younger and less experienced men. These men are usually recruited from the graduating classes of the technical colleges. Unfortunately, however, owing to the peculiar and complex nature of central-station work, they do not fit into this type of organization and assume responsible productive work so quickly or so readily as they can do in other lines of business.

Realizing this and following in the footsteps of other large successful public utility companies, the Duquesne Light Company decided in the spring of 1923 to inaugurate an apprentice engineering course and to take on each year ten college graduates for this training. Owing to delay in getting started, however, only seven graduates were obtained who could successfully pass the rather severe entrance requirements. These men were enrolled for a course extending over a period of fifteen months. Starting as a new idea with the company and organized under the stress of extreme business activity, it was impossible to conduct the first class on as thorough a program as was desired. Nevertheless, it must be said that the first year of this course has been a marked success. Numerous requests were received from the different department heads asking for the services of the apprentices as soon as they should have finished their training. Accordingly, it has been possible to place these men just graduated in the departments they desired, which in most cases happened to be the departments requesting their services.

### TRAINING METHODS USED

The apprentice engineers are required to report as a class to the office of the assistant to the vice-president, where they are assigned for a period of one week. The morning of the first day is devoted to a general "get-acquainted" meeting, after which a list of desirable rooms, prepared by the personnel department, is furnished them, in order that they may get satisfactory accommodations in case they have not already done so. The next day is devoted to a general discussion by the assistant to the vice-president in outlining the course

and a general talk on the company organization and system, together with other necessary information. The men also receive descriptive literature of the company's properties, which they are instructed to study. The rest of the week is devoted to meeting and hearing talks by the general officers and department heads of the company.

After the first week in the office of the assistant to the vice-president, the students are started on their routine assignments, two men to each department, in accordance with the following schedule: Engineering department, three months; substation department, three months; power station department, two months; distribution department, two months; meter and test department, one month; miscellaneous and optional assignments, one month. This makes up a total of twelve months, it having been decided to shorten the course from the original fifteen, as it was thought that one year was about as long as it would be possible to center the attention of the men on a training course.

Each department has an apprentice engineering supervisor to whom the apprentices report while in the department and who is responsible for the proper routing of the men through the department. The supervisor also acts as a sort of adviser to them in various matters. Each department has also a very definite schedule showing the assignments of the men while in the department, copies of which are given to each apprentice when he first reports, at which time the supervisor usually devotes some time to further explaining the duties and functions of the particular department. The month of miscellaneous and optional assignments, of which one week is devoted at the first of the course in the office of the assistant to the vice-president, is so designed as to allow the remaining three weeks to be spent as optional assignments in any department, even though it be a department to which the men are not regularly scheduled.

Saturday morning of every week is divided into three periods and the entire class is assembled at a central point and addressed by the different leading men in the various departments on the details of their respective work. Thus, although regular classes of instruction are not held, the apprentices gain a pretty thorough knowledge of the duties of all the various divisions and sections in the different departments, even though they may not necessarily be assigned to these sections during their course.

### Close Checks Are Maintained During Training Courses

As the apprentice leaves a department a standard report form is forwarded to the office of the assistant to the vice-president by the department supervisor, grading the apprentice on subdivisions under the following headings: Physical qualities, intelligence, leadership, personality and "general." Thus very careful check is kept on the men as they go through the course. On leaving the department each apprentice is required to furnish a list of questions to the supervisor, which the latter answers and uses as a guide to assist in the instruction of other men to follow. In addition to the weekly lectures, personal inspection trips are arranged to the Westinghouse Electric & Manufacturing Company and other large industrial plants. These trips are in charge of competent guides, who carefully explain the technical and other points of interest to the men.

Another educational feature is the circulation of helpful literature to the apprentices to be read in their spare moments. This consists of personal efficiency books and other interesting and instructive publications, all of which are secured from the company's library. At the end of the course the men are expected to prepare a list giving three departments in which they would elect to settle in the order of their preference, and every effort is made to place them in the department of their first choice. At this time a certificate or diploma is given each apprentice stating that he has satisfactorily completed the prescribed course and been promoted to a regular position in the company. This certificate is signed by the general manager and the assistant to the vice-president.

### A Social Club

In order to introduce a social element into the course and to assist the apprentices in getting better acquainted, since they are generally strangers in the city, an apprentice engineers' club was organized. This club is entirely a non-company activity, conducted personally by the apprentices, and the usual offices are held by active apprentices, although the graduates have a "graduate representative" and the company a "company representative," the latter acting solely in an advisory capacity. This club holds regular monthly "get-together" affairs, such as picnics, swimming parties, dances, and theater parties.

APPRENTICE ENGINEERS' CLASS, 1924—DUQUESNE LIGHT COMPANY

Left to right, standing—H. S. Fisher, Ridlonville, Me., University of Maine; R. J. Tennant, Morgantown, W. Va., University of West Virginia; D. Rasmussen, Oxford, Ind., Purdue University; W. J. Lyman, Pittsburgh, Pa., Carnegie Institute of Technology; R. P. Egry, Dayton, Ohio, Ohio State.

Left to right, seated—J. D. Reeve, Pueblo, Col., University of Colorado; J. F. Wulfetange, Bellevue, Pa., Penn State; S. G. Page, Dubuque, Iowa, Iowa State; R. R. Murdock, Wellsville, Ohio, Ohio State; G. G. McElheny, Pittsburgh, Pa., Carnegie Institute of Technology.

The club has also leased a 150-ft. river frontage at Logan's Ferry, on the Allegheny River, forty-five minutes from Union Station, where it has established a permanent apprentice engineers' camp containing a large, well-equipped bunk house, an excellent assembly hall, a mess house and kitchen and numerous cottages. Electricity, gas and running water complete the necessary comforts, and the apprentices find the outdoor life during the summer months very enjoyable after their four years' close confinement in college. A basketball and volley court, canoes, a river float, a radio, phonographs and other accessories are included. A cordial

invitation is extended by the apprentices to their company friends to visit and enjoy the facilities of this camp. The ten new apprentices received each spring are also to be invited to spend the summer months there, which will afford them an excellent opportunity to look around before settling in a permanent home for the winter.

### HELP OTHER EMPLOYEES

From the above it will be seen that the apprentice engineers' course is very thoroughly organized and established on a practical educational basis for the training of these college men. Not only does it aim to train the apprentices to fit better into the organization, but it also offers many other practical points of advantage. It means that each year ten men thoroughly acquainted with the personnel and functions of all the company's departments will be absorbed in regular positions in the different departments. Here their intimate knowledge of the organization of other departments will be of material assistance to regular employees who for lack of time and opportunity have been unable to become properly acquainted with the other departments. Furthermore, the talks delivered by the section and division heads outlining in detail the duties and functions of their departments not only have a tendency to require them to review their own subjects thoroughly, but such talks are usually taken down by a stenographer and typewritten, so that copies may be furnished to other interested parties—all of which tends further to educate the regular employees as to the work of the different departments. The questions prepared by the apprentices, as well as those asked verbally at the meetings, often reveal conditions which may be materially improved, but which have been overlooked by the busy executives.

A certain amount of desirable advertisement is also received from this course. Descriptive pamphlets have been prepared, outlining the course and describing the company's organization and system, and these are distributed to the leading colleges throughout the country. The apprentices themselves, being well satisfied with the progress they are making, often write back to their classmates telling them the advantages and opportunities offered by the company, and so considerable interest is created among outsiders as to both the course and the company. This was evidenced in the present year, when many more applicants for enrollment were received than could be accepted.

One other point of considerable importance is the fact that the company holds these ten men always in readiness to be concentrated at any point on the system to assist in any emergency whatsoever where men of their caliber and training can be employed to advantage. Last year, owing to the great number of householders moving about May 1, the contract counter was literally swamped with work. The entire class of apprentice engineers was assembled, and, after some preliminary instruction, the men were placed at the counter, working in with the regular employees. Here they performed their duties in a very creditable manner and materially assisted during the rush season. This is only one out of several instances where emergency work has been handled by these men. Such time is deducted from the month of miscellaneous and optional assignments and tends further to broaden and instruct the apprentices in the many problems of public utility work.

## Electrical Progress in France

THE great increase in the generation and application of electrical power in France is largely due to the abundance of hydraulic power; next, to the increasing mileage of high-tension distribution lines, and finally to the disposition of industry to make use of this power and to the necessity of its adoption for the performance of much industrial labor formerly accomplished by hand, because of the shortage of labor throughout the country.

The rating of French central stations has risen from 1,447,750 kw. in 1921 to 2,647,000 kw. in 1923. The length of lines has increased in the same period from 22,942 km. to 70,000 km. These now serve a population of twenty-four millions out of a scant forty millions total. The total capital invested in the central-station industry is estimated at 3,500,000,000 francs, of which 2,097,000,000 francs represents stocks and 1,403,000,000 francs represents bonds. There are over twenty hydro-electric plants of more than 20,000 kw., while five exceed 40,000 kw. Certain steam stations are of greater importance, as that at Comines, rated at 75,000 kw., which is soon to be advanced to 125,000 kw., and that at Saint-Ouen, which in 1926 will reach 350,000 kw., not to mention the Gennevilliers station, which, with a present capacity of 240,000 kw., is being increased to 320,000 kw.

During 1923 there was put into service 45,000 kw. on the État system, and a like volume in the Department du Nord. In the Alps, the Lyonnais, the Saint-Étienne district and the Massif Central of mid-France the figure reaches already 120,000 kw. The central station of Viclaire in the Alps sends its energy to Lyons. In the Northeast lines of 90,000 volts have been constructed as well as extensions of large volume in Alsace.

### MOVE TO ELECTRIFY RAILWAYS

The electrification of the principal railway systems accounts for other important installations, notably the Midi, the Orleans and the Paris, Lyons & Mediterranean lines, the total length of the electrification already planned being 8,800 km. These projects call for the expenditure of 5,000,000,000 francs, of which 1,800,000,000 francs will be expended on central stations and distribution networks, 1,400,000,000 francs on lines and substations and 1,800,000,000 francs on locomotives. The program of expenditure is to cover twenty years.

There are actually in service or under construction 9,000 km. of high-tension circuits, of which 5,000 km. is of from 40,000 volts to 90,000 volts and 4,000 km. of from 90,000 volts to 150,000 volts. The number of rural districts electrified has increased from four thousand in 1913 to more than ten thousand in 1924. More than thirty departmental communal syndicates have been organized in the past year.

Exports of electrical machinery, equipment and appliances more than doubled during the last calendar year as compared with imports. Imports as to value increased 36,000,000 francs, virtually 30 per cent, but in tonnage bulk the increase was but 5.7 per cent. The depreciation of the franc may be said to have accounted for this otherwise seeming anomaly. Exports actually increased over 1922 by 72,000,000 francs, 36 per cent, while in tonnage the increase was 3.716 metric tons, 28.6 per cent.

# Power-Factor Rate Clauses

## Transformer and Regulator Costs Are Most Affected by Poor Power Factor—Operating Expenses Increase Slightly—Rates Should Care for Demand and Energy Charges—New Rates Advocated

By R. R. HERRMANN

*Assistant Professor of Mathematics and Mechanics, University of Minnesota, Minneapolis, Minn.*

POOR power factor has long been recognized as a nuisance by central-station companies, and steps are being taken at the present time by a number of companies to correct the condition. Their method of correcting poor power factor consists in whole or in part, first, of penalizing the customer who has a power factor below a certain amount, for example, 80 per cent; second, of offering a premium for good power factor and imposing a penalty for poor; or by charging for demand on the kilovolt-ampere basis. An analysis of these different methods shows that they have advantages and disadvantages, and this article attempts to formulate a form of rate clause which seems to be superior to those now used.

### For and Against Existing Clauses

One of the commonly used power-factor rate clauses is based on a demand charge which is fixed by the kva. of maximum demand. This clause is formulated on the basis that transformer cost is based on kva. rating, line cost is based only partly on kva. rating, regulation cost is based on kva. and generator cost is based on kva. rating. Another form of clause frequently used consists of a demand charge based on the kilowatts of maximum demand. This clause has the following arguments for its use. (1) Metering is cheaper. (2) The investment is not proportional to kva. or kw., so why not take the easier and cheaper method? (3) The prime mover installation is based on kilowatt demand. (4) The kw. demand charge gives a slightly lower rate to power customers than to lighting customers as compared with the use of the kva. demand charge. (5) The power factor generally increases when the demand increases. (6) It is doubtful whether the premium or penalty the central station can afford to impose is sufficient to induce the customer to install power-factor corrective apparatus. (7) The kva. demand clause will not improve power factor at light load, which may be more injurious to operation than is commonly realized. For example, if the power is a maximum with 90 per cent power factor at 3 p.m. as compared to a condition at 5 p.m. when the kva. demand is three-fourths as much as at 3 p.m. and the power factor is only 50 per cent, a worse condition would obtain than if the power factor were 100 per cent at 5 p.m.

Another frequently encountered clause uses the reactive energy charge. It is based on the following arguments: (1) A charge for reactive-kva.-hours will cause a customer to have nearly 100 per cent power factor at all times. (2) A direct saving in coal can be shown because of the decreased copper losses. (3) The distribution and transmission line cannot be rated in kva. because (a) the voltage used is the important factor, (b) the distance is important, (c) a great portion of the cost is in poles, right-of-way, etc., and is not determined completely by kva. capacity. (4) When a line becomes inadequate the voltage can be raised, etc. (5) A reactive-kva.-hour meter can be used to determine a sort of average power factor, which if the penalty is set high enough, will insure a fairly good power factor at all times. (6) The same make and type of meters can be used throughout the system. (7) The company's expense does not vary monthly, and this permits comparisons based on the fact that permitting the demand charge to vary monthly is not more correct than to charge for reactive kva.-hours. (8) By determining an average power factor from the reactive and active kva.-hours and giving a premium when the reactive kw.-hours are less than one-half the active, and imposing a penalty, based both on demand and reactive kva.-hours, when the reactive energy is more than one-half of the active, a rate would be given more nearly in accordance with the cost of service.

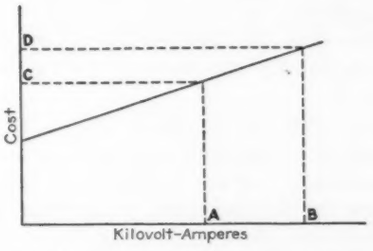



FIG. 1—CUSTOMER SHOULD PAY FIXED CHARGES ON EXTRA TRANSFORMER INVESTMENT

### Central-Station and Customer's Viewpoints on Power-Factor Correction

From the standpoint of the central-station company the rate cost should not give a premium greater than the cost to itself of correcting the low power factor. Another element is that a power-factor penalty which would cause ill feeling among customers and would prevent the company's obtaining power business should not be adopted. The power-factor clause used should be easy to explain and easy to impose, even though not so correct as some other clause more complicated in understanding and application. Energy sold at a low rate should have more consideration in regard to power-factor correction than energy sold at a high rate. It is evident that even though the investment increases as the kva. supply increases, it does not increase at a rate proportional to kva.

The viewpoint of the customer on power-factor correction is that penalties for power factor less than a certain value should be counterbalanced by premiums for power factor greater than the same value. Moreover, a leading power factor should offset a lagging one if the load and duration are the same. It is also evident that conditions of operation may be such that

the customer cannot keep his power factor up even if he were willing to do so; why, then, should he be penalized for something he cannot help?

### ADDITIONAL INVESTMENTS CAUSED BY LOW POWER FACTOR

In supplying any customer with electrical energy there are certain cost items which increase as the power factor decreases and other items which remain the same or nearly so. Each company can calculate what such increase in expense is for each particular element which constitutes a part of the whole. To illustrate this a few main items of investment will be cited:

1. *Transformers.*—Transformers are rated in kva. The load a transformer is capable of carrying is dependent upon its heat-withstanding and radiating qualities, which in turn are dependent upon the current flowing through it. The cost of transformers installed can be represented by a curve somewhat as shown in Fig. 1. If a customer with a 100 per cent power factor takes *A* kva. of installed transformer capacity and another customer with the same kw. demand requires *B* transformer capacity on account of his poor power factor, certainly the last customer should pay the fixed charges on the extra investment, represented by the difference between *C* and *D*.

For example, assume that the cost of transformers installed on poles in banks of three is as shown by the following equation:

$$\text{Cost (\$)} = 5.4 \text{ kva.} + 166. \qquad (1)$$

Changing this to power factor, it becomes:

$$\text{Cost (\$)} = (5.4 \text{ kw.} \div \text{P.F.}) + 166. \qquad (2)$$

There are now three variables which necessitate a series of curves, hyperbolas, as shown in Fig. 2.

From the last equation an idea of the relation existing between power factor and installation cost can be obtained by asking the question, "What must be the power factor in order to double the cost?"

Mathematically stated it is:

$$\frac{5.4 \text{ kw.}}{\text{P.F.}} + 166 = 2(5.4 \text{ kw.} + 166) \qquad (3)$$

and

$$\text{P.F.} = \frac{5.4 \text{ kw.}}{10.8 \text{ kw.} + 166} = \frac{1}{2 + (30.8/\text{kw.})}$$

The following tabulation shows the power factor necessary to double the transformer investment:

| P.F. ..... | 0.18 | 0.25 | 0.33 | 0.37 |
|---|---|---|---|---|
| kw. ..... | 9 | 15 | 30 | 45 |

This indicates that the investment is doubled much more rapidly by decrease in power factor with large installations than with small ones.

2. *Distribution Lines.*—A similar situation exists for distribution lines. The minimum pole height is determined largely by the clearance necessary, and in cities the number of poles per mile is determined largely by the length of the blocks. The size of the wire cannot be reduced below a certain minimum size on account of necessary mechanical strength. The greatest part of the cost of installation depends upon factors which have very little to do with the carrying capacity of the line, unless, of course, the length of the line is very great. Even then the voltage can be increased with the resulting increase in carrying capacity.

One might even go so far as to contend that very little, if any, of the transmission cost is increased by reason of poor power factor, unless, of course, the load is extremely large and the power factor extremely low.

TABLE I

| Time | Kva. | Kw. | P. F. | $\phi^0$ | Reactive |
|---|---|---|---|---|---|
| 8 a.m. | 200 | 190 | 0.95 | 18.2 | 62.5 |
| 9 | 250 | 240 | 0.96 | 16.25 | 70.0 |
| 10 | 200 | 190 | 0.95 | 18.2 | 62.5 |
| 11 | 150 | 75 | 0.50 | 60.0 | 130.0 |
| 12 | 125 | 25 | 0.20 | 78.45 | 123.0 |
| 1 p.m. | 75 | 15 | 0.20 | 78.45 | 73.0 |
| 2 | 200 | 180 | 0.90 | 25.80 | 87.0 |
| 3 | 100 | 30 | 0.30 | 72.60 | 95.0 |
| 4 | 150 | 50 | 0.33 | 70.5 | 141.0 |
| 5 | 150 | 50 | 0.33 | 70.5 | 141.0 |
| Average | 160 | 104.5 | 0.562 | 50.895 | 98.50 |

In order to cast some light upon the variation of investment in transmission and distribution, it may be well to determine what might be called an "irreducible minimum" for a hypothetical "zero demand" for both three-phase and single-phase service. Suppose that the demands of all customers were constantly reduced so as to approach a demand of zero. What investment would be necessary to supply the service to the customers?

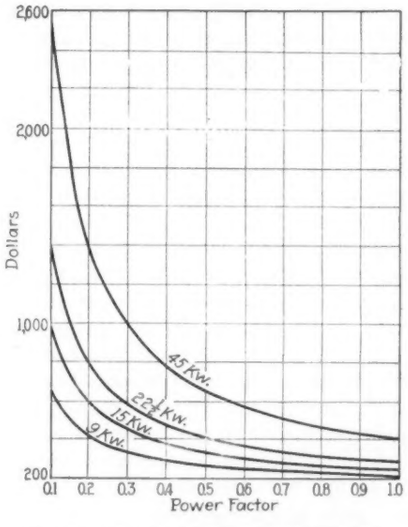



FIG. 2—EXAMPLES OF TRANSFORMER-BANK COSTS WITH CHANGES IN POWER FACTOR

The cost of transmission and distribution could be cut to a certain minimum figure. For example, 230 volts would be the highest voltage necessary because with zero demand there would be no drop in voltage. A small generator only would be required. But some cost items would be changed very little, as, for example, pole cost. On account of mechanical strength a minimum-size wire must be used. Then as soon as a load of any considerable size were put on this 230-volt system it would become inadequate. But by installing transformers at the source of supply and at the customer's load to boost the voltage to 2,300 and again reduce it, the capacity of the system can be increased a hundredfold. Whatever the load carried at 230 volts may be, by the expenditure of a certain amount

TABLE II

| Time | With Assumed P.F. Kva. | With Assumed P.F. Loss | With 100 per Cent P.F. Kw. | With 100 per Cent P.F. Loss |
|---|---|---|---|---|
| 8 a.m. | 200 | 10.0 | 190 | 9.00 |
| 9 | 250 | 15.6 | 240 | 14.40 |
| 10 | 200 | 10.0 | 190 | 9.00 |
| 11 | 150 | 5.6 | 75 | 1.40 |
| 12 | 125 | 3.9 | 25 | 1.25 |
| 1 p.m. | 75 | 1.4 | 15 | 0.75 |
| 2 | 200 | 10.0 | 180 | 8.10 |
| 3 | 100 | 2.5 | 30 | 0.22 |
| 4 | 150 | 5.6 | 50 | 0.62 |
| 5 | 150 | 5.6 | 50 | 0.62 |
| Total | ... | 70.2 | 1,045 | 45.36 |

in transformers the load can be increased 100 times. The demand charge should, then, include the transformer and generation fixed charges and a certain percentage of the fixed charges on the line, which portion may be distributed equally among customers, irrespective of their demands, or may be absorbed by the energy rate.

There is an upper limit where the carrying capacity of the transmission and distribution system cannot be increased; for example, a city ordinance may prohibit the use of voltage higher than 2,300 in residential districts and 13,200 in other districts. An increase in load may then force the use of larger conductors with the resultant increase in fixed charges.

All this leads one to believe that the power-factor penalties should include very little, if any, of transmission and distribution costs, but that fixed charges for generation and transforming equipment should be included.

3. *Generation.*—With this item the effect is about the same as with transformers—namely, that only a portion of the investment in generation is increased because of poor power factor. The boilers and turbines need be very little larger, whereas the alternators must be. The power-factor penalty should be sufficient to take care of the extra investment in the alternators only.

### Extra Operating Expense

The operating expense of a system is likely to be more affected by poor power factor than is at first assumed. There is a certain loss in kilowatt-hours between the customer's meter and the generator, these losses, of course, being both iron and copper losses. Poor power factor will change the iron losses only in so far as larger transformers with their corresponding larger iron losses are required. With copper losses the same cannot be said. These vary with the square of the current. Suppose that the copper loss at 100 per cent power factor is 5 per cent. The current at other power factors, assuming some particular voltage, will vary inversely as the power factor. From this the following equation results:

$$\text{Loss}_{100} = \text{loss at 100 per cent P.F.} = q(I_{100})^2$$

$$\text{Loss} = \text{loss at any other P.F.} = q\left(\frac{I_{100}}{\text{P.F.}}\right)^2$$

But when the load is steady:

$$\text{P.F.} = \frac{\text{kw.-hr.}}{\sqrt{(\text{kw.-hr.})^2 + (\text{reactive kva.-hr.})^2}}$$

So that:

$$\text{Loss} = qI_{100}^2\left[1 + \left(\frac{\text{reactive kva.-hr.}}{\text{kw.-hr.}}\right)^2\right]$$

$$= \text{loss}_{100} + \text{loss}_{100}\left(\frac{\text{reactive kva.-hr.}}{\text{kw.-hr.}}\right)^2$$

This indicates that if the loss in copper at 100 per cent power factor is, for example, 5 per cent, the loss at any other power factor is greater by a percentage obtained by multiplying five by the ratio of reactive to active kilowatt-hours squared.

As an example assume the load given in Table I.

Some calculations are interesting, as, for example:

The power factor obtained by averaging the hourly power factor is 56.2 per cent.

The power factor obtained by dividing the kw. average by the kva. average is 65.4 per cent.

The power factor obtained by dividing the reactive kva. average by active is about 72.7 per cent.

The power factor obtained by using the average angle of lag as 50.89 deg. is about 63 per cent.

The power factor obtained by using the average reactive kva. and the kva. is about 79 per cent.

From Table I some more interesting figures may be obtained. Suppose that at 200-kw. 100 per cent power factor the loss is 10 kw. Table II shows the results.

With 100 per cent power factor at all times the loss would be 4.34 per cent, and with the assumed power factor it would be 6.71 per cent. The figures assume a constant voltage at the load, whereas this is not the case. The voltage would in all probability drop with increased load, causing a higher amperage with a correspondingly higher loss.

### Cost Values for Generating Stations

In the case of steam stations low power factor frequently necessitates the operation of one or several units for power-factor correction alone. This expense can easily be determined for any particular station. Of course, one might say a spare unit is kept floating on the line to insure uninterrupted service at all times, so why not correct the power factor at the same time? This is true, and for that reason little or no charge can be made against poor power factor. Nevertheless, *extra* generating capacity must be available in case of breakdown, and that extra capacity could be smaller with unity power factor. This is, however, a fixed charge and should be taken care of by the demand charge.

In the case of hydro-electric stations with sufficient water at all times to take care of the requirements, no additional operating expense is caused by low power factor—that is, provided continuity of service demands the running of an extra unit.

Usually in a case of a combination of steam and hydro-electric stations the hydro station can absorb the wattless current when the flow is small and the steam stations can absorb the wattless current when the flow of water is large. Little expense can be charged against poor power factor.

### Conclusions

From the foregoing the following conclusions may be reached:

1. Transformers and regulators are the most affected by power factor.

2. The operating expense is slightly increased.

3. In order to take care of the two power-factor expenses both the demand and energy charges (for steam stations) should be affected.

4. Suggested clauses to affect the demand and energy charges are as follows:

(a) The extra demand in kva. caused by low power factor shall be charged for at one-half the regular demand charge.

(b) The number of kilowatt-hours shall be increased by the percentage obtained by squaring the ratio of reactive to active energy registered and multiplying it by five.

## Belgian Congo Railroad Electrification

A SPECIAL commission appointed to consider the question of the electrification of the railroads in the Belgian Congo has just presented a report in which it is recommended that the first 56½ miles of the Congo Railway be immediately electrified and that a company be formed to establish hydro-electric plants to utilize water power in the Lower Congo.

# Letters from Our Readers

## The Meter-Service Switch Question

*To the Editors of the* ELECTRICAL WORLD:

In the ELECTRICAL WORLD of November 15, page 1049, there appeared an article entitled "Facts Versus Fancies in the Meter-Service Switch Question," by Joseph Sachs, chief engineer of the Johns-Pratt Company, Hartford, Conn. In this article are a number of statements with which I am not in agreement, and as they seem to me to be open to misinterpretation and diametrically opposed to the facts as I have stated them I take this opportunity to comment on the situation and Mr. Sachs' article.

On page 1051 Mr. Sachs says: "It has been pointed out by Mr. Palmer (ELECTRICAL WORLD, June 14, page 1225) that a significant difference between an 'AA' switch and an 'A' switch (Underwriters' laboratories' classification), when both of them embody accessibility of main fuses when dead and prevention of access to live parts, lies in reversibility of connection to the supply and load wires in the former, whereas in the latter it is necessary to connect the supply or line wires to the switch terminals and the load wires to the fuse terminals." I cannot accept responsibility for such an interpretation, for I did not point out the above "significant difference" or refer in any way to the class "A" switch. As a class "A" switch cannot because of its design "embody accessibility of main fuses when dead," I am at a loss to understand the author's statement. I admit that connection reversibility does not guarantee correct switch installation, but the classification "AA" switch, with its "connection reversibility" characteristic, does guarantee against its incorrect connection into the service, which is all that can be asked.

It is impossible to connect an "AA" switch incorrectly *into service.* It will not function as a switch when improperly connected, and even if improperly connected, the fuse terminals are dead when exposed. This is the reverse of the condition found in the class "A" switch, where the switch apparently functions correctly with the connections reversed but the fuse is alive and accessible in the grounded inclosure of a so-called and probably so-labeled "safety fuse box."

Mr. Sachs says "the important differentiation in fused meter service switches exists in the accessibility or the inaccessibility of the main fuse and not in peculiar construction of parts to permit reversibility of line or load." The author clearly means the class "AA" switch by this reference to "peculiar construction of parts," but apparently fails to realize that a switch which permits reversibility of line and load alone presents an accessible dead fuse. I cannot believe any utility would adopt as a standard a switch having an accessible main fuse which was not dead when accessible.

Referring to Mr. Sachs' statement on page 1052, "Mr. Palmer does not discuss service economies in his article," I have never advocated a cheap service switch where low first cost was the only incentive for use. When I presented to certain utilities of this country the first commercial type of externally operated fuse switch having a sealed fuse, it was received with much enthusiasm; but after several years' experience these utilities found that it was impossible to maintain seals on boxes having an inaccessible or sealed fuse, and every one of the utilities which originally accepted with enthusiasm the inaccessible service fuse now insist upon classification "AA" switches at every service entrance and appreciate the economic value of "connection reversibility," inasmuch as it effectively prevents any possibility of the fuses and fuse terminals being alive when accessible and reduces seal breakage.

On page 1051, paragraph 5, Mr. Sachs says: "On three-wire services, with inside-connected potential coil meter, removal or blowing of the main service side fuses in either outside leg 'kills' the meter, but unmetered energy is nevertheless supplied through the neutral and the other outside leg. The ease of practicing this method of beating the meter by mere disconnection of a single invitingly accessible fuse is obvious." This overlooks the fact that utilities using accessible fused-type switches (classification "AA") use three-wire meters with separate potential terminals connected to the line terminals of the switch, which prevents the use of unmetered energy possible in the first-named and now obsolete method of three-wire meter connection.

It has by no means been proved that the blowing or abuse of the main fuse may be largely reduced by providing accessible load-side fuses. This might be possible if the service switch could be fused to its maximum capacity, as suggested by Mr. Sachs in the article under notice, but the size of the fuse in the service switch is not determined by its capacity but by the capacity of the conductor it protects. On page 1050, paragraph 3, Mr. Sachs states that "on nearly 90 per cent of the service installations in the country a good approved 30-amp. externally operated inclosed switch will satisfactorily serve for controlling load." With but one branch load-side fuse of 15 amp. capacity this works very well, but with two branches (one for lighting and one for convenience outlets, a very common arrangement) a short circuit on a convenience outlet protected by a cold fuse at a time when the load on the lighting outlet has warmed the 30-amp. main fuse frequently results in the 30-amp. main fuse opening before the cold 15-amp. fuse in the convenience circuit, so that the question resolves itself into what proportion of the 30-amp. fused protected services have more than one branch or load-side fuse.

Standardization of the service entrance is, I believe, carried to a much more logical conclusion with the classification "AA" switch than with the types of switches suggested by Mr. Sachs. The manufacturers of classification "AA" meter-service switches use a standardized and interchangeable box, and when so desired by the utility supplying service in the territory where such switches are used, the "AA" switches may be supplied with a universal adapter which standardizes the installation for any modern bottom-terminal induction meter or serves as a blank end wall when the box is originally installed or if thereafter the meter is removed, thus eliminating the necessity of the utility carrying a stock of so-called meter adapters.

The real question at issue is: What kind of a service control device best suits the consumer and the utility that have to live with it? As Mr. Sachs says: "Ultimately the fittest will survive. Let us be fair in striving for survival and concede merit where merit exists."

GRANVILLE E. PALMER,
President
Palmer Electric & Manufacturing Company,
Cambridge, Mass.

### What Is a "Standardized" Meter-Service Switch?

*To the Editors of the* ELECTRICAL WORLD:

In the November 15, 1924, issue of the ELECTRICAL WORLD, page 1049, an article appeared entitled "Facts Versus Fancies in the Meter-Service Switch Question," by Joseph Sachs. It discussed the use of the so-called "standardized meter-service switch" and the possible application of the circuit breaker as an improvement for meter entrance switches. In our last article (ELECTRICAL WORLD, May 17, 1924, page 1003) we suggested that the circuit breaker should seriously be considered for meter-service protection.

We are thoroughly aware of the fact that there may be at present no inclosed circuit breaker on the market that would completely fulfill the requirements. The development of the small circuit breaker for use on small electrical appliances has made very rapid strides in the past few months, and we firmly believe that a circuit breaker will be developed that will satisfy the requirements for meter-service protection.

Mr. Sachs asserts in his article that the subject is treated by him both from the manufacturer's and the operator's viewpoint. We, of course, are limited in our discussion owing to the fact that we can speak only from the operator's standpoint, with only something less than two hundred thousand inclosed meter-service switches under our immediate supervision. The writers feel that Mr. Sachs has ably chosen his title, "Facts Versus Fancies," since to many operators the term "standardized" as applied to meter-service switches is indeed a capricious exercise of the imagination. Can it be that "the good ship 'Standardized Meter Service Switch' " is a phantom?

It will, perhaps, not be denied that Mr. Sachs is very able to present the views of a manufacturer, since he is a pioneer in the field of fuse production and since he is chief engineer of one of the meter-service switch manufacturers who have been prominent in the promulgation of the so-called "standardized" meter-service switch. Though the term "standardized" is used profusely throughout his article, one fails to find any direct statement explaining just what a "standardized" meter-service switch is, or by whom any standard for meter-service switches has been established or accepted, and one may gain the idea from Mr. Sachs' article that this so-called "standardized" switch is manufactured by most of the producers in this field.

We should like to ask Mr. Sachs:

1. What does the term "standardized" meter-service switch mean?

2. By what authoritative body or association has "standardization" of meter-service switches been set forth?

3. What are the specifications for a "standardized" meter-service switch?

4. Has the N. E. L. A. meter committee recognized or approved the use of the term "standardized" in reference to any meter service switch, or has it definitely declared that the term "standardized" is not to be used in reference to this committee's action?

As to relative merits in the question of "circuit breaker versus fuses," we heartily agree with Mr. Sachs that "ultimately the fittest will survive."

The attitude of the operators in the central-station industry is aptly expressed in the late report of the Association of Edison Illuminating Companies' meter and service committee as follows:

*Circuit Breakers for Service Protection.*—A development of considerable importance during the past year has been in connection with the proposed use of a small-capacity circuit-breaker switch in place of the usual service-entrance or meter-service switch with fuse protection. The question of supply and maintenance of service fuses is one of increasing importance because of the rapid increase in small-capacity services and the increasing emphasis placed upon continuity of service as essential to the high standard of service generally aimed at today.

The growing use of ironclad construction for service and meter installations and the question of the customer's ability to restore his own service whenever necessary are both important factors pointing to the desirability of a circuit-breaker device of some sort, if a satisfactory one can be obtained.

Quite diverse arguments are presented on this problem, which is treated so differently by different utilities, according to local conditions and policies; but in general it is agreed that a very satisfactory solution would be afforded if a reliable and inexpensive circuit-breaker device were available which could be reset by the customer as often as necessary, but which could not be blocked or abused as so frequently occurs in the use of fuses.

A large amount of attention has been given to this development by several manufacturers, and with sufficient progress to date to warrant the belief that the problem can be worked out in a satisfactory manner. Real difficulties are involved, due to the natural limitations of the problem, but your committee has been very active in endeavoring to aid this development, and it is hoped that devices of the desired type will be available for actual field experience at an early date.

The problem does not confine itself to services of small capacities, since the same conditions exist in the larger installations, but it is obvious that from the point of numbers the normal 30-amp. services are the ones in need of early and serious consideration. It is confidently hoped by your committee that the coming year will see tangible progress in the working out of this important problem.

R. C. FRYER.
Union Gas & Electric Company, Cincinnati, Ohio. L. J. GREGORY.

### Joint Use of Poles

*To the Editors of the* ELECTRICAL WORLD:

I was very greatly pleased with the policy of the ELECTRICAL WORLD in publishing such a paper as that of Prof. A. E. Knowlton on joint use of poles. This subject has clearly had too little open discussion, and there is too great a tendency to make decisions without a full showing of the facts, both in individual cases and as a state or national issue. Professor Knowlton's treatment of the subject is naturally that of an administrator who has obtained a large measure of success by refusal to allow any interest to control the development of others, since in Connecticut the state commission is well informed and asserts its control of any situation which has a tendency to become controversial.

As Professor Knowlton very properly remarks, wisdom does not die with Connecticut, even regarding the joint-pole situation, and he properly leaves plenty of room for advance, appreciating the possibility that later progress in other states or nationally may improve upon early practice in Connecticut and may prove to be still more effective in dealing with this many-sided question, involving, as it does, both engineering and public policy in an important degree.

I hope that the publication of Professor Knowlton's article will stimulate other discussions and that the ELECTRICAL WORLD, as an open forum for the presentation of facts, will be utilized as much as possible in this connection. A display of all the facts and a discussion of their proper evaluation cannot help but clarify the atmosphere and hasten proper conclusions.

National Electric Light Association, New York, N. Y. W. J. CANADA, Chief Engineer.

# Central Station and Industrial Practice

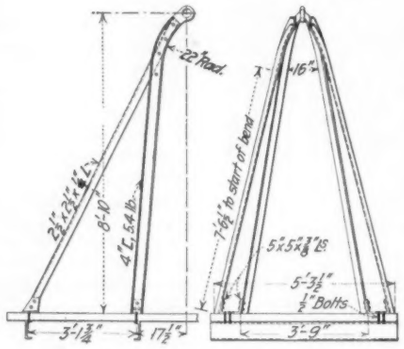
## Erecting Seventy-five Poles per Day with Five Men

By J. C. Dodds
Superintendent Distribution, Houston (Tex.) Lighting & Power Company

By using the special equipment shown in the accompanying illustration the Houston (Tex.) Lighting & Power Company has been able to set as many as seventy-five poles a day, using five men where building a continuous line. This does not take into account the time or labor in digging the holes, which is done by another crew of men unless only a few poles are to be set. Of course, if the country is very rugged and delays are encountered between pole holes, the foregoing number of poles cannot be set in one day.

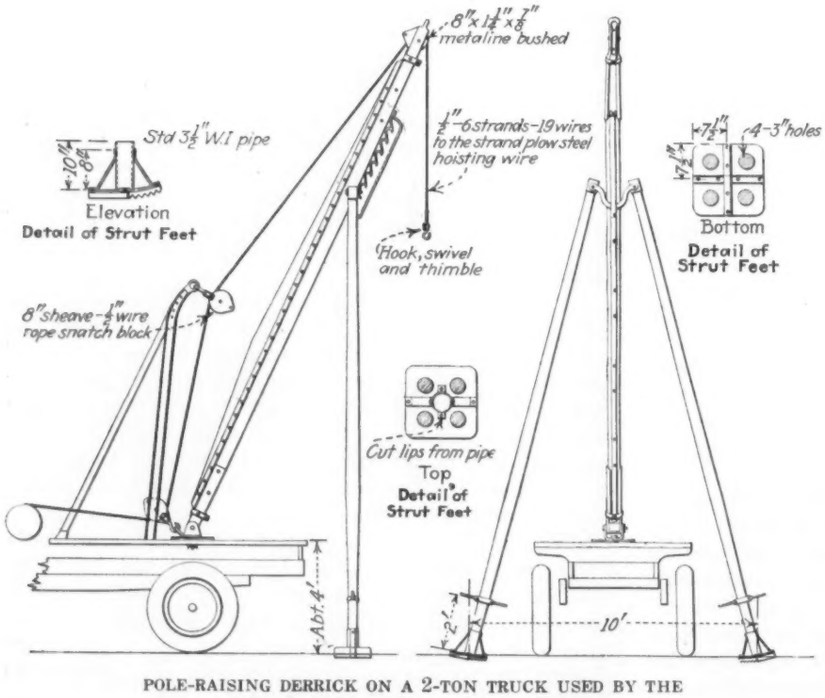
Before this special equipment was developed (when pike poles were employed to erect poles in the usual manner) nine men including the truck driver were required to erect a pole. With this equipment only five men are required. Normally the new method is about four times as speedy as erection by the old methods. Where only two poles have to be erected, this method is cheaper by $1 per pole.

In operating this equipment one man is required to handle each leg, one man to put the line around the pole, and the truck driver to operate the winch. The foreman makes the fifth man. The pole erection crew is followed by four men who pike the




DETAILS OF CRANE FOR ERECTING DISTRIBUTION POLES

pole into a vertical position, fill in the dirt around it and tamp it. By removing the pin at the bottom of the boom after lowering to a horizontal position, it can be slid up under the truck seat so that only a small portion of one end extends over the truck platform. The struts can likewise be carried on the truck platform very conveniently.




POLE-RAISING DERRICK ON A 2-TON TRUCK USED BY THE HOUSTON LIGHTING & POWER COMPANY

## Experience with Walls of Gas-Fired Furnaces

By M. L. Wright
Chief Engineer of Power Plants, Southwestern Gas & Electric Company
Shreveport, La.

For some time trouble has been experienced with excessive erosion of the front walls of gas-fired furnaces, especially in the vicinity of the openings through which the gas is admitted to the furnace. Consequently several materials have been experimented with to find the solution. Firebrick laid up in the usual manner, plain cement, reinforced concrete and plastic firebrick and fireclay have been tried. Relatively speaking, the firebrick wall is most expensive, the concrete wall least expensive but not so lasting, and the combined plastic firebrick and fireclay wall the next cheapest and most durable. The concrete walls are made of a one-three-five mixture and are easily patched with plastic firebrick.

In making the plastic firebrick and fireclay front walls forms are built up from the fire-room floor level about 3 ft., filled with "quick patch" made by the Green Firebrick Company and tamped solidly in place. These walls are not subjected to the weight of the boiler or the upper portions of the front wall. The material used is essentially a mixture of ground firebrick and fireclay. Some of the plastic firebrick and fireclay front walls, which are 12 in. thick, have been in operation one year without any apparent deterioration, the boilers having operated at an average rating of about 100 per cent during this time.

## Success of Time-Delay Low-Voltage Protection

By J. A. Vanderpoll
Assistant Field Engineer Westinghouse Electric & Manufacturing Company
New York, N. Y.

The writer has had an opportunity to investigate the results obtained with the time-delay low-voltage protection system advocated in Electrical World for November 22, page 1111. During last winter this company installed this system in five 150-hp. synchronous motors driving pumps in a large manufacturing

plant. Previous to this installation the conditions were as follows:

At every measurable voltage dip the low-voltage tripping mechanism would trip the motor circuit breakers and the plant would be shut down until all motors were started again. The stagnation of the manufacturing process caused a considerable loss. The power company received several complaints, and by checking up its trouble reports we found that in 1923 this plant was shut down on 70 per cent of the number of voltage dips occurring on the line supplying these customers.

Since installation one year has elapsed, and while other high-tension customers have reported a number of shutdowns due to dips, the improved plant has not suffered at all. The power company, as well as the manufacturer in question, are very much satisfied with the results.

# Sectionalizing of High-Voltage Lines

## Automatic Apparatus that Has Been Recently Developed by the Alabama Power Company Described—Switch Has Several Unusual Design Features

BY GEORGE H. MIDDLEMISS
Superintendent of Distribution and Maintenance
Alabama Power Company, Birmingham

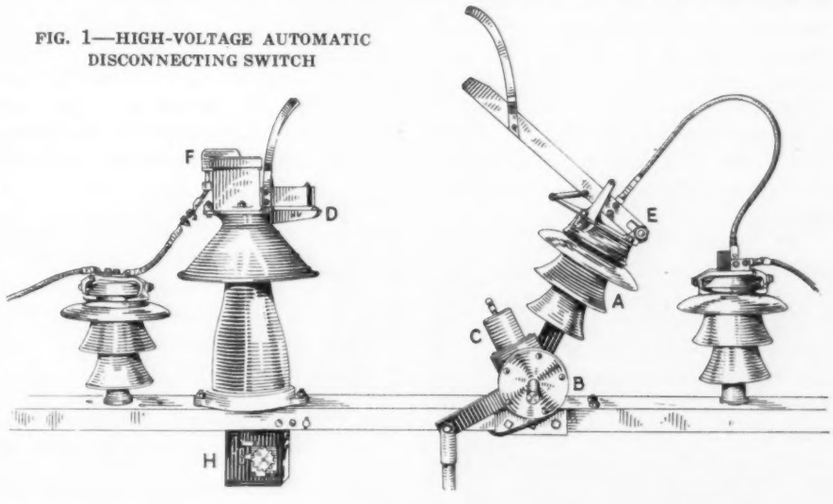
CENTRAL stations operating over large territories with load centers small and scattered, and served by means of long radial high-voltage feeders, are faced with peculiar problems in maintaining continuity of service. Because of low load densities and lines of great lengths, the revenue per mile of circuit is such as to limit the cost of installation of supply substations and the amount of switching apparatus. The same limitations apply to the erection of automatic oil breakers in the line for the purpose of cutting off sections, should trouble develop. As feeders become longer, with increasing number of tap circuits, the exposure to lightning hazards is proportionately increased, and more frequent installation of some form of sectionalizing devices becames essential for the purpose of shortening patrol operations in event of failure and for immediately re-establishing service to as many customers as possible by disconnecting sections in fault.

In emergency patrol operation we have found that under the most carefully planned arrangement of air-break switches and location of patrolmen complete sectionalization and tests for trouble involve some 30 per cent to 40 per cent of the total time of the outage for the circuit. Of course, for the most part, the emergency patrol is started on all portions as soon as trouble occurs, and then the extra men are withdrawn or transferred as soon as tests show the particular section in trouble. To sectionalize automatically would not only cut down outages by the percentages above noted, but would make men starting on other portions of the system available immediately for the patrol of the section actually in trouble, thereby materially reducing the time required to patrol and to repair the failure.

In certain portions of the system of the Alabama Power Company there are loads of small capacities scattered over mountainous territory, where road conditions are not the best and patrol operations difficult. To insure greater continuity of service and facilitate emergency patrol at minimum costs, the automatic high-tension sectionalizer has been developed, tested and installed.

The apparatus is shown in Fig. 1 and is for use on the 44,000-volt distribution system. The entire equipment consists of a combined switch and relay unit, a motor-timing relay and a 12-volt storage battery.

FIG. 1—HIGH-VOLTAGE AUTOMATIC DISCONNECTING SWITCH



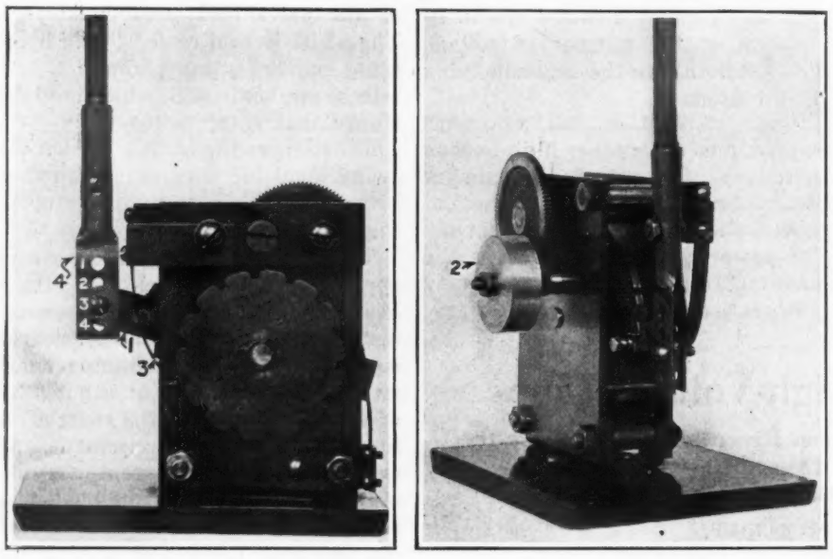

The switch possesses certain unusual features of design. The swing insulator *A* (Fig. 1) is actuated to open position by springs mounted in a sheltered position on the under side of the galvanized channel support. The blade is held closed by an operating handle acting through a trip release mechanism, *B*, which is so designed that energization of the trip coil *C* releases the shaft to which the swing insulator is mounted and thus permits the blade to move for opening the switch.

The arcing horns are of heavy copper, to provide safe closing into a heavy short circuit. Very small disturbances have been experienced when the switch is closed into a short circuit of 1,200 amp., at a potential of 44,000 volts across the switch. A number of such tests were made, and the pitting of non-current-carrying areas of the main clips and blade was so small as to be inconsequential. Neither was there any appreciable burning of the arcing horns.

The blade in closing swings downward, striking a resilient bumper, *D*, and then moves forward into the contacts under the sleet hood, the slot *E* at the other end causing a small shock when insulator *A* is released for opening. This blow tends to break away any gumming or corrosion of the contacts. Where sleet conditions are severe, a motor mechanism is planned for operating the switch instead of the spring arrangement.

The relay built on the special porcelain insulator is of the delay-contact type, with inverse time element, and does not operate to open the sectionalizer until after the oil breaker at the supply substation clears the circuit from the bus. Thus the sectionalizer is never required to open under potential and is not designed for this purpose. Figs. 2 and 3 show the relay itself, how it is designed and constructed.

The plunger of the trip coil *F* in




FIGS. 2 AND 3—RELAY FOR OPERATING DISCONNECTING SWITCH

Fig. 1 is connected to the arm (1), Fig. 2, of the delay-contact relay. Upward movement of the arm engages the gear train and puts into rotation the inertia wheel (2), Fig. 3, introducing an inverse time element in accordance with the typical characteristic curves shown in Fig. 4. A downward movement of the plunger after the oil circuit breaker has opened actuates the contact wheel to close the trip circuit through the brush (3). The relay is adjustable for time setting by varying the size of inertia wheel (2), and for current by changing the position of plunger in reference to the solenoid at (4). The relay is slipped into a weatherproof housing *H* of Fig. 1. For solidly grounded systems there is a relay for each switch unit. All relays are constructed of non-corrosive material and ruggedly built to reduce necessity of maintenance and adjustments.

At supply substations for the 44,000-volt distribution circuits there are installed reclosing relays for operating oil breakers on a one-minute interval, two-shot lockout basis. If the breaker trips, it recloses in one minute. If trouble persists, it immediately trips again and recloses the second time in one minute, and if it trips again immediately, the breaker is locked out against further reclosings until relays are reset by hand.

To use the automatic sectionalizer under such a reclosing scheme, the relay and control circuits are arranged as shown in Fig. 5. The timing relay is motor-driven by an 80-amp.-hr., 12-volt automobile-type storage battery, also used for energizing the trip circuit. It is intended that this battery shall be changed every three or four weeks by a patrolman, who will substitute a new unit and bring the one in service to headquarters for recharging.

The timing relay has split pole pieces, and the lower half *A*, pivoted at *B*, carries a wormwheel *C* with contact levers *D* and *E*. When the relay is in operation, magnetic attraction between the pole pieces raises the wormwheel *C* to engage the worm *N* on the armature shaft *H*. When the motor circuit is broken, the wheel *C* is disengaged from *N* and drops back to a position ready for another cycle of operation.

Assume that a persistent case of trouble develops beyond the automatic sectionalizer. Then the oil breaker at the station will trip and the momentary contact of the delay contact completes the circuit through the contacts *K* and *M* of the timing relay. This causes the lower field piece to be lifted for engagement of the wormwheel. Contacts *L* and *K* are thus closed, putting the motor armature *H* into operation. In approximately one minute the arm *D* makes contact with *F*, and when the first reclosing and trip of the oil breaker at the substation occurs, the delay-contact relay contacts are again momentarily closed, completing the circuit through the contact *FD* and trip coil, thus opening the automatic sectionalizer. The motor continues in operation until the arm *E* breaks the contacts *G*. Then motor is stopped, *C* disengages from *N*, and the relay resets itself for another cycle of operation. In one minute after the first reclosing and trip of the oil breaker at the substation the second reclosing occurs and, the automatic sectionalizer being open, service is re-established on the line up to its location.

If, instead of persistent trouble developing beyond the automatic sectionalizer, an insulator flashover occurs during a lightning storm, the oil breaker at the substation will be tripped out and the motor relay put into operation through the closing of delay-contact relay contacts. However, assuming no permanent injury to the insulator because of the flashover, the oil breaker at the substation will remain in after the first reclosing. There being no short circuit beyond the automatic sectionalizer, the delay-contact relay will not operate and the arm *E* will revolve until contacts *G* are opened; then the motor will stop and the relay will set itself for another complete cycle of operation.

After the automatic sectionalizer has opened because of trouble upon the line connected thereto, it is reclosed by hand after a patrol has been made and the fault cleared.

On the system of the Alabama Power Company the one-minute interval for the oil breaker to reclose upon radial 44,000-volt circuits has been adopted as a standard, for the time being. Should it be necessary later on to decrease the reclosing interval, the setting of the timing relay on the automatic sectionalizer can be varied by moving the arm *D* closer to the contact *F* initial position. In this manner the timing of this relay can be made to match the

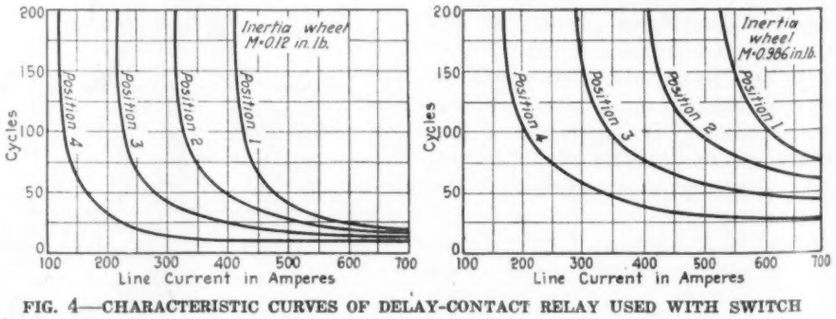



FIG. 4—CHARACTERISTIC CURVES OF DELAY-CONTACT RELAY USED WITH SWITCH

interval set on the reclosing relays for the oil breaker and reclosing intervals can be reduced to a very short period.

The automatic sectionalizing switch is being installed as a protective device upon some of our larger 44,000-volt customer substations, of capacities of 2,000 kva. and above. In such installations our practice in the past has been to install a form of air-break switch with high-tension fuses, but operating experience with the fuses has been unsatisfactory. The

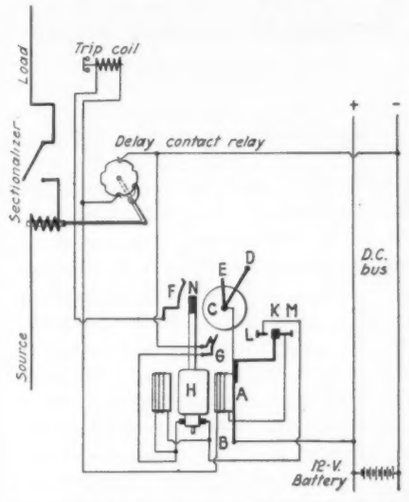



FIG. 5—CONTROL CIRCUIT FOR AUTOMATIC SECTIONALIZING SWITCH

fuse frequently fails to clear when blown, with resulting damage to the insulators and other equipment, thereby increasing the length of the outage. At such substations the automatic sectionalizer is not equipped with the timing relay, and in case of bushing failure or insulator flashover the switch opens immediately after the breaker at the primary substation clears. The electrician at the customer's plant usually makes an immediate inspection, and if no serious damage is found upon the substation apparatus, he closes the automatic sectionalizer and restores service.

In some of our prospective long-line developments we expect to realize material benefit from the use of the automatic sectionalizer. We still have to gain experience with this apparatus under severe lightning conditions. However, flashover values are liberal, and we anticipate no trouble from failures of the insulation. Where sleet conditions are severe, added precautions must be taken to insure certainty of switch opening, and a motor mechanism is planned to replace the springs that are ordinarily used.

## Overhead Distribution Maps for Central Stations

AT THE recent Empire State Gas and Electric Association convention at Syracuse, N. Y., H. S. Chartier of the Fulton County Gas & Electric Company presented a paper giving additional information on the method of keeping overhead distribution maps described by him in the ELECTRICAL WORLD for October 13, 1923, page 763. The system referred to has been used by his company for more than three years and has proved itself of great value. Vertical mounting of the maps has been found to be the most satisfactory. Maps so hung are rugged, easily read, have a low maintenance, require little space, can be easily removed from the holder for close inspection or corrections and can be securely locked in a fireproof and dustproof vault. By the use of such maps countless records can be associated by the reader, giving him the required information in a short period of time.

As described in the previous article, these maps show all primaries, secondaries, transformers and poles. The number of each pole is placed on the maps so that any desired information can be found in the files, which are kept in accordance with the map. Poles were originally placed on the maps by means of a round rubber stamp (with a $\frac{1}{8}$-in. inside diameter). On account of inaccurate stamping and the tendency of a stamp to smear, the use of the bow pen and ink has been resorted to. Since poles are seldom changed, this method has been found to be satisfactory. Each pole shows distinctly whether it is one in which there is full ownership, part ownership or attachment rights. A key is placed on the map which designates the various symbols. It is readily seen that when notice of trouble on a system is received much time can be saved by referring to the map before starting the work.

### EXPERIENCE SATISFACTORY DURING PAST YEAR

The past year's experience has brought to the company's attention the use of something more substantial as a marking for transformers. Round white stickers placed just beside the pole, of a size adequate to permit the number and capacity to be placed on them, have proved more satisfactory than the round white-head tacks formerly used. In case of a change of rating or a removal, these stickers can easily be removed by the use of a sharp knife.

Persons formerly using these maps, especially when in a hurry, would accidentally knock the tacks out. In fact, many tacks dropped out of themselves owing to constant vibrations, the stem of a flat-head tack being somewhat wedge shaped. The round-glass-head tack has a round pointed stem and when once inserted has a tendency to stay in place. However, Mr. Chartier said that they had found no better system for the street-lamp maps. These maps should show only street-lighting circuits, poles and lamps. For a series system a dotted line could be used for a single conductor and a solid line would represent a double conductor. Each circuit should be of a given color and all lights on that particular circuit should be shown with the same color.

Colored round-glass-head tacks serve well for this purpose. For example: A small colored-head tack would represent a 60-cp. arc, a large colored-head tack a 250-cp. incandescent, and the same size tack with a white band across the face a 600-cp. "Novalux." When changes are made in the candlepower of a lamp, the only alteration that has to be made on the map is to replace the old tack with a new one representing the new lamp. This method permits great flexibility. If a system say of three separate circuits is to be changed over to two separate circuits, a rapid determination of load, where to break and where to tie in, can be made, thus saving time and labor.

### TRANSMISSION MAPS

Maps of high-voltage transmission have also proved themselves of great value. As new hamlets come up for consideration a glance at the map gives one a definite idea for a tie-in for supply. On transmission-line maps all substations, generating stations and tie-ins could be represented by symbols on stickers placed at the proper location. Sectionalizing switches, lightning arresters and other apparatus can well be marked in the same way. When placing secondary extensions on a map care should be exercised so that at any time when the secondary is removed and the primary extended the draftsman can easily rule over the light-colored secondary and save erasing.

Oftentimes, especially in old dis-

tribution systems where rapid progress has been made in consumption, many small transformers have been hung to supply new localities. By means of an up-to-date map it is possible to determine the replacement of several small transformers by a larger one, thus reducing the core loss and raising the efficiency of the distribution system.

The maintenance of such a map system, once constructed, is quite low. Plotting of extensions, etc., can easily be handled by some one of the office force handy with drawing instruments. By thus placing the various sections in a systematic manner in the holder a rapid survey can be made of an entire city or locality.

## Trucks Pay for Themselves in Six Months

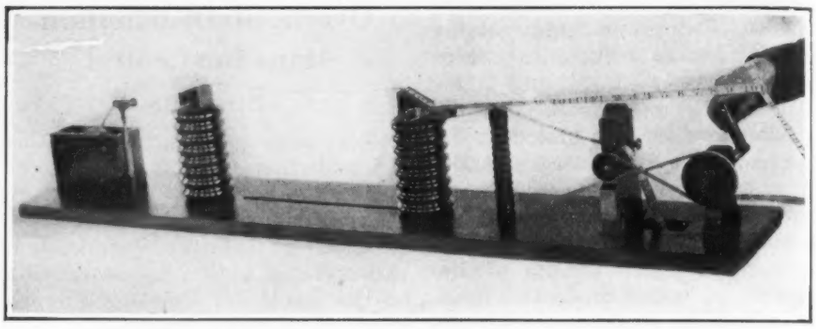
BY H. B. CLEVELAND
Gunn Carle & Company, San Francisco

INDUSTRIAL electric trucks in the plant of the Hall-Scott Motor Car Company, San Francisco, have proved a highly satisfactory and paying investment since their installation. One of the trucks has reduced the cost of handling material 83.3 per cent, and the entire equipment will pay for itself in the first six months of operation.

Formerly freight cars were unloaded with two trucks requiring eight men, resulting in slow handling and an untidy pile in the yard. The work is now done with four men and one electric truck. The method is to load the castings onto dumpbody skids which are picked up by the electric truck and transported through the yard and up a ramp 30 ft. long with a 14 per cent grade and dumped into the correct bin. The actual saving is four men at $5 each, or $20 a day total, and the freight cars are unloaded in one-third the time required by the older method.

The shops of this company handle heavy gasoline engines, automobile parts and miscellaneous material. Two elevating-platform industrial electric trucks are used. One is for heavy duty and the other is for handling lighter material. In the heavier truck twelve cells of seventeen plates each are used, and in the lighter truck six cells of seventeen plates each are required. The small truck operates in the shipping department and is used to transport the finished automobile axles from the assembly room to the storage room. Formerly this work required three men with small hand-lift trucks. The work is now done by one man with the electric truck. The services of two men at $5 a day each are thus dispensed with.

The complete installation consists of one Wright-Hibbard truck, one Baker R. & L. truck, two "Exide" batteries, two dumpbody skids and one trailer.



APPARATUS FOR TESTING CONDUCTIVITY OF MEASURING TAPE

## Testing Measuring Tapes for Conductivity

BY C. B. WRIGHT
Supervisor System Regulation Division, Duquesne Light Company

LINEMEN and construction men frequently have occasion to throw a measuring tape over an energized circuit. There is a possibility that the tape may contain metallic threads or that the paint may be a conductor of electricity, so in order to "play safe" this company has arranged to test all such tapes. The tapes are passed over two electrodes spaced 12 in. apart as shown in the accompanying illustration. The potential between the electrodes is maintained constant at 20 kv. The two rubber rollers provide sufficient friction to unwind the tape from the container as soon as the crank is turned.

The base of the testing apparatus is made of ebony asbestos board, all metal parts are lacquered brass, the tape holder, crank and supports are hard rubber, and the electrode supports are porcelain. It should be noted that the operator is perfectly safe when using the machine.

ELECTRIC TRUCKS TRANSPORTING MATERIAL IN MOTOR-CAR FACTORY

# Central Station Business

## Holding Company Securities Sold on Customer-Ownership Plan

THE practicability of selling holding company securities under the customer-ownership plan in the territory of subsidiary companies has been clearly demonstrated by several sales which have lately been conducted on the properties of the Cities Service Company. The most notable of these has just been concluded by the Empire Gas & Fuel Company, Bartlesville, Okla., where 20,118 shares were sold by 3,917 employees in ten days, the number of purchasers being 6,651.

This campaign represents what is believed to be the highest record ever achieved in a ten-day customer-ownership drive in which company employees were used as salesmen. It is perhaps even more remarkable in view of the fact that in June of this year the company had sold a little more than 10,000 shares of its own 8 per cent preferred stock to customers in its territory.

### Employees as Salesmen

In the later campaign, as in all customer-ownership sales carried on by the Cities Service Company in which employees act as salesmen, the men and women employees were organized into teams by departments—operating, new business, accounting and so forth—each with a team captain. The employees, through a brief series of talks, were instructed in the selling features of the security and furnished with a small pamphlet which further outlined the desirability of Cities Service Stock as an investment.

An ascending scale of commissions for stock sales was paid as follows: $1 per share for the first ten shares, $1.50 for the next ten shares and $2 per share for all sales over twenty shares. In addition to this, prizes for the first and second high name of each team were given. Employees not only utilized their spare time but also never missed a chance to make a sale during office hours whenever the opportunity presented itself in their contact with customers.

The Cities Service subsidiaries, in addition to supplying electric service in Bartlesville and natural gas in a considerable part of Oklahoma, Missouri, Kansas and Texas, also operate a number of gasoline filling stations throughout the state, which are in charge of employees. The fact that these men sold a considerable number of shares to automobilists who patronized the filling stations forms an interesting sidelight on the possibilities of customer ownership.

Compared with the campaign in June during which stock of the Empire Gas & Fuel Company was sold, this second campaign for the sale of the holding company's stock is considered by the Cities Service Company to have been much more successful. In both cases the stock was sold at the current market price, which fluctuated slightly from day to day. It was, however, found that the holding-company shares were somewhat easier to sell, which was attributed to the diversity of investment represented by properties in widely separated parts of the country and by the different kinds of utility service rendered. Moreover, the number of shares per sale was slightly higher for the holding-company stock, being slightly more than three shares per customer, while in the June campaign for the local stock less than three shares were sold per customer.

Sale of holding-company securities to customers of subsidiaries offers a comparatively new method of extending customer ownership.

351,598
Customers of Cities Service power, light and manufactured gas companies, pay reasonable bills for excellent service.
290,000
people pay bills for natural gas supplied by Cities Service companies.
Hundreds of thousands of motorists buy Cities Service gasoline and lubricants.
CASHIER
Pay Electric Bills Here
Those Who Pay Monthly Light Bills Can Receive Monthly Dividends
1,187 People
In Missouri alone, now own Cities Service stock.
250 of these stockholders are here in St. Joseph.
Many of these stockholders are our customers.
We want more customer ownership.
You Help to Make Earnings Possible
Why Not Share In These Earnings?
"WHY are you selling Cities Service Company preferred stock here in St. Joseph?" our customers may ask.
A fair question, surely and worthy of this frank answer:
"Because we believe in customer ownership."
Henry L. Doherty, President of the Cities Service Company, started the customer ownership movement. He was the first man to put in practice the logical idea that the people who make earning possible—the employees and customers of a company—should share in the company's earnings.
When he organized Cities Service Company he made it easy for employees and customers to become partners—with the result that today Cities Service Company has 100,000 security holders.
But not all of Cities Service Preferred Stock is owned by customers. Because of the very exceptional worth and yield of the security, considerable was purchased by professional investors living in the big money centers—people whose friendship and partnership are of no value to the company.
It is to take the security from these holders and place it in the hands of employees and customers that this partnership offer is being made in St. Joseph.
Mr. Doherty's ambition is to secure for Cities Service Company as nearly as possible 100% employee and customer ownership. He has no desire for greater ownership for himself. His holdings are ample for his moderate means. He has no family, no near heirs, no desire or incentive to pile up a large fortune.
He has, however, a very great ambition to leave Cities Service Company as his memorial, operated by men he has trained, owned by employees and customers—a great perpetual institution for service.
St. Joseph is the second of the several thousand communities served by Cities Service Companies in which this customer ownership offer will be made.
As soon as Cities Service can reach the more than a million customers of its electric and gas companies and its gasoline stations, it will make them all a similar offer—though we believe that all of them have to pay a higher price than you will here in St. Joseph.
When the customers of Cities Service Company realize the safety and yield Cities Service Preferred Stock, Henry L. Doherty's dream of customer ownership will come true.
How It Benefits You, the Customer
Some of the benefits of customer ownership to the customer are:
1. You get a safe investment—guaranteed by the fact that the services and products we sell are the sort that modern Americans are never willing to do without. When you sell necessities of life, often without competition and generally under State regulation, you are in a sound business.
2. You get unfailing dividends. A company glad to make your friendship could not afford to sell you anything except a sure dividend payer.
3. Part of the property you share in serving is located here at home where you can keep an eye on it.
4. Your money is invested in lines of business you are familiar with—lines you are in touch with daily and nightly for your whole life.
5. The men who manage and operate the St. Joseph subsidiary are your neighbors—your friends. They know first hand about Cities Service Company; they, too, are stockholders; they can be reached if you wish information about the company and your investments.
6. A resale service is provided, in case you need to get your money out, by the St. Joseph Company.
7. Enough earnings come from power and gas companies—companies operating practically without competition and under laws that provide that they are entitled to a fair return on the value of their property to pay dividends on the preferred stock.
How It Benefits the Company
1. By taking you and its other customers into partnership the company secures the interest and co-operation of the very people whose friendship is most valuable—its customers.
2. You and its other partners, as stockholders, become interested as the workers, in the efficient operation, in the growth of its business. You make valuable suggestions and criticisms. You help us to give better service.
If you are a customer of the Company, you will on Thursday receive an extremely favorable partnership offer in Cities Service Company. We feel sure you will find it of interest.
Another Block Square of Cities Service Customers
If You Use Cities Service Gasoline and Oils Why Not Share in Cities Service Earnings?
St. Joseph Railway, Light, Heat & Power Co.
Which Is a Part of Cities Service Company

ADVERTISEMENT USED IN SALE OF HOLDING COMPANY STOCK IN ST. JOSEPH, MO.

Frequently conditions are such that it is not feasible to sell stock of the local utility because all available issues have been exhausted or there is no immediate need for additional financing. However, by selling stock in the parent company it is not only possible to build good will for the local utility, but a better public understanding of the purpose and nature of the holding company will be created.

## Small Store Refrigeration

**Cheaper than Ice—Meat Markets and Others Offer a Most Attractive Small-Power Load**

BY W. J. KYLE
Consulting Engineer, Philadelphia, Pa.

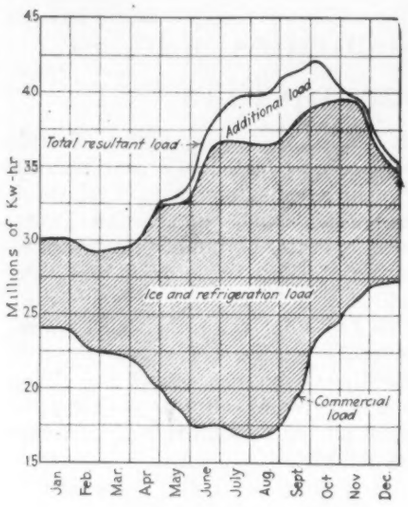
MECHANICAL refrigeration offers a most desirable source of revenue for the central-station company, particularly as it possesses advantageous load characteristics.

Probably the small butcher or meat market as a class presents the most likely prospect for the adoption of electrically operated mechanical refrigeration.

Mechanical refrigerators can be installed in meat markets without extensive changes inside the cooler, and the machine, condenser and motor can be installed in the basement, requiring very little space. The entire operation of the plant can be made automatic, and the only attention required is to see that the machine and motor have sufficient lubrication.

The advantages of mechanical refrigeration to the meat market are: Easy control of temperature is afforded at will or automatically; the air in the cooler is dry; meat is kept solid and firm, making cutting easy and rapid; trimming is reduced, which often means the difference between profit and loss to the butcher; ability is gained to purchase meats at favorable market; the butcher is enabled to hang meats to season without fear of loss; the cooler is sanitary and the structure of the cooler will last longer owing to the absence of moisture. A market equipped with mechanical refrigeration can place expansion piping in the display counter, which protects it from flies and other insects and prevents handling by the public. It has been found that displaying cuts of meant in this manner disposes of cheaper cuts, which otherwise go into the "corning tank." This obviously increases the sales and profits.

Many installations of small refrigerating plants in meat markets are making great savings in cost of operation and a substantial profit on the investment. A plant in Brooklyn is a typical example. This plant is installed in an average meat market,




EFFECT OF REFRIGERATING BUSINESS ON YEARLY LOAD CURVE

where the year's ice bill was $801.22. The refrigerating machine started operating in January, and the bill for power for the ensuing year was $230.13, or a difference of $571.09.

Assuming that the cost of this plant installed ready to operate was $2,000 and allowing 15 per cent for interest, depreciation, insurance and taxes, or a sum of $300 per year, there is left a net profit on the investment of $271.09, a direct, tangible profit without considering the many other advantages.

It is interesting to know this result is borne out by the figures on the same plant for the year 1923. It is difficult to estimate what the ice bill would have been for this period as the meat dealer's business increased considerably, but for the sake of comparison it will be assumed that ice would have been the same as 1921, or $801.22. The power bill for the year 1923 was $199.85, or a difference of $601.37 gross saving. Allowing $300 for fixed charges, leaves $301.37 as a direct profit on investment.

### OTHER FIELDS FOR REFRIGERATION

The field for small refrigerating equipment is not limited to meat markets. Diaries, florists, soda fountains, ice-cream manufacturers, produce dealers, restaurants, sugar factories, slaughter houses, oil mills, margarine plants, paraffine plants, hotels, hospitals, indoor skating rinks, mortuaries, fish freezing are prospects for mechanical refrigeration where the advantages are equal to those afforded by markets. Every industrial plant is a prospective purchaser of a water-cooling system.

The industrial applications of mechanical refrigeration are only beginning to be discovered and put to use. Refrigeration plays an important part in the manufacture of ball and roller bearings. Chemical plants use it in the crystallization process. It

## Teaching Teachers Prone-Pressure Resuscitation

TWENTY young women employees of the Edison Electric Illuminating Company of Boston were recently graduated as prone-pressure-method instructors, the group constituting the first class of women instructors in this field in New England if not in the country. They will teach the six hundred other women employees of the company by classes and were trained under the direction of Capt. Jack Wallace of the American Red Cross.

is important in the manufacture of phonograph records, in the making of candy and biscuits and in apple storage and fruit pre-cooling.

With both economical conditions and good judgment in favor of mechanical refrigeration, there is a large field for the use of central-station power which can be developed by co-operation with refrigerating equipment manufacturers and a careful study of his territory by the power sales engineer.

## Efficiency Awards for Thinking Employees

BY DOUGLASS BURNETT
Consolidated Gas, Electric Light & Power Company of Baltimore

TO ENCOURAGE employees in all departments to perform their work in the most efficient manner and by the most economical methods the Consolidated Gas, Electric Light & Power Company of Baltimore about two years ago established a series of attractive awards for efficiency suggestions. In a letter to employees in May, 1922, Herbert A. Wagner, president of the company, explained the efficiency award offer as follows:

It is the desire of the management to encourage every one in the organization to develop his powers of observation and his mental capacity for constructive effort, with the assurance that successful efforts will bring reward and advancement. To this end a new series of awards for efficiency suggestions has been established.

Here is the plan: For suggestions which can be practically applied to produce an operating saving of at least $100 per month, first prize, $100; second prize, $75; third prize, $50. Awards are to be made monthly, if practicable, or to a total amount of $3,000 every twelve months.

A committee on awards has been designated which will be expected to make its announcement on the first of each month, covering such decisions as may have been reached during the previous month.

In October, 1922, Mr. Wagner amplified his original offer by a second letter to employees as follows:

It has been gratifying to note the responses of the employees to the encouragement for suggestions embodied in the letter on efficiency awards, dated May 1 and addressed to all employees. In addition to the stipulations embodied in the letter of May 1, the management makes the following offer:

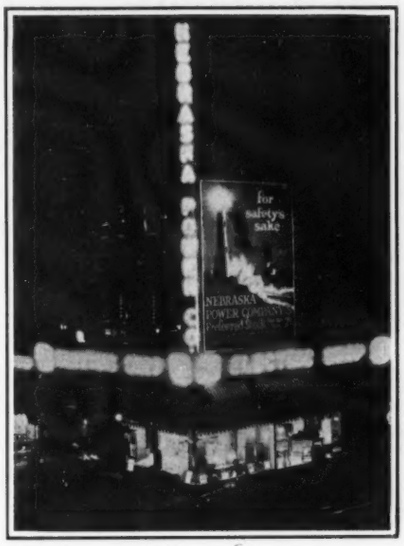
For suggestions registered with the efficiency awards committee that are adopted and are estimated to produce an operating saving of at least $25 per month there will be a prize of $25, and for such suggestions producing an operating saving of less than $25 per month there will be a prize of $10.

It will be noted that this offer is different from the general run of "suggestion" plans in that it demands of the author a finished product. His suggestion must be complete and demonstrate its practicability and worth, and a monetary value, net in its result, must be attached to the saving accomplished. In this way, the committee in charge of the operation of this offer is relieved of considering anything other than concrete cases. When a suggestion which complies with the rules and scope of the offer is received by the committee, it is referred to those in the company concerned with the application or adoption of the plan, and if they report favorably thereon, the committee decides on the award to be made. If the suggestion is rejected by the departments interested, they must give report in duplicate as to the reasons why it is impracticable or impossible to adopt the suggestion, and in advising the author of the outcome of his suggestion a copy of this report is sent to him, so that he has the complete story. This also gives the author an opportunity to dispute, if he desires, the conclusions reached. Where an award is made, a letter is prepared for and signed by the president of the company presenting the check to the author.

At the annual meeting of the Baltimore Gas and Electric Association, which is an employees' association, medals are awarded to all those who have received an efficiency award during the year. These medals are of French bronze, containing a cut of Rodin's "Thinker," and have the name of the recipient and the month of his award engraved on the reverse. The medals are so arranged as to permit their use as a watch fob.

Since the announcement of this offer the committee has received, to December 1, 1924, 167 suggestions, and there have been forty-seven awards, aggregating $2,345. This includes fifteen awards of $10 each. Some of the suggestions were rejected because, while they probably represented an economy, they did so at the expense of good will, good service and safety.

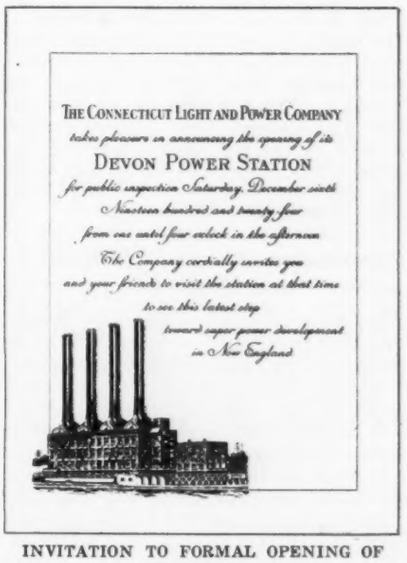
## Company Sets Example in Electrical Advertising




THE Nebraska Power Company has conducted a continuous campaign for the sale of electric signs for the last five years, offering merchants liberal time payments, as described in the ELECTRICAL WORLD for April 12, 1924, page 732. Upward of $100,000 worth of electric signs were sold last year, and a large factor in this success has been the company's own liberal use of electrical advertising. The above view shows the extensive sign and window lighting of the company's general office building and electric shop on one of the principal corners in Omaha.

## Devon Station Latch String Out

THE new Devon steam plant of the Connecticut Light & Power Company was thrown open to public inspection on December 6 in order that business men and others in the company's territory might become acquainted with this notable addition to the state's electrical generating resources. An attractive engraved invitation illustrating the


THE CONNECTICUT LIGHT AND POWER COMPANY
takes pleasure in announcing the opening of its
DEVON POWER STATION
for public inspection Saturday, December sixth
Nineteen hundred and twenty four
from one until four o'clock in the afternoon
The Company cordially invites you
and your friends to visit the station at that time
to see this latest step
toward super power development
in New England

INVITATION TO FORMAL OPENING OF DEVON PLANT

plant and outlining the scope of its service and possible relation to superpower development was sent by the company to other utilities, power customers, representative business men and public officials.

# Digest of Electrical Literature

## Hydro-Electric Development and Steam Equipment

*Hydro-Electric Plant for Rhodesia.*—A plan for harnessing the Mulungushi Falls to supply power for a mine and lead and zinc concentrating plant 35 miles distant is briefly described. The ultimate development will be for 10,000 hp. at a 1,000-ft. head. The construction includes a dam which will back the water for a distance of 15 miles and a tunnel 15 ft. x 12 ft. x 700 ft. long. The cost is estimated at £150,000 and the annual saving over cost by the present steam plant at £15,000.—*Electrician (England)*, Nov. 21, 1924.

*Development of the Gas and Oil Turbine.*—The machines here described have been developed by Hans Holzwarth, chief engineer of Thyssen & Company in Germany. They are said to be particularly suited for use in large sizes, and since the gas turbine will operate on blast-furnace gas it is expected to find particular application at steel plants. The turbine consists of a group of explosion chambers arranged radially around a central shaft carrying the wheel. The charge is forced into a chamber through the inlet valves at 40 lb., and ignited, which results in a temperature of 2,500 deg. F. and a pressure of 250 lb. The article gives curves for computing the efficiency under various assumed conditions and makes a number of cost comparisons between gas-engine. gas-turbine and steam-turbine plants, which, however, are admittedly based in part on expectations.—*Iron Age*, Nov. 20 and 27, 1924.

*Periodical Variations of the Water Flow in Rivers.*—KRAABOL-JORSTAD.—The author discusses statistical information on water flow and atmospheric precipitation for different rivers in Norway. The relations between water flow and precipitation are illustrated, as well as the well-known relationship between the variations of the sun spots and the precipitation.—*Teknisk Ukeblad (Norway)*, Nov. 7, 1924.

## Generation, Control, Switching and Protection

*Insulating Oils for Oil Circuit Breakers.*—DEAN HARVEY.—Methods of sampling, testing and purifying are described, with precautions to be observed as to storage, putting oil into service and maintenance.—*Electric Journal*, December, 1924.

*Remote Control for Hydro-Electric Plants.*—Special features of the largest combined development of this type at Dams No. 8 and No. 9 on the Trent Valley Canal system of the Hydro-Electric Power Commission of Ontario are discussed. In all, six units in the two plants will be entirely controlled by supervisory equipment now being installed, the control station being at the Ranney Falls generating station.—*Electrical News*, Dec. 1, 1924.

*Power Studies in Illinois Coal Mining.*—A. J. HOSKIN and T. FRASER.—This eighty-two-page bulletin has been written in response to requests received from Illinois coal operators for dependable information concerning various phases of the general power problems. The possibility of lowering power costs is being carefully considered by all progressive operators, and this booklet should go a long way in helping the operator to find a solution of his particular problem. Among the subjects discussed are uses of steam and electricity at Illinois coal mines, characteristics of typical mines, power characteristics, power generation, power consumption, power requirements, use of central-station power and the factors affecting power costs.—*Bulletin No. 144 Engineering Experiment Station, University of Illinois.*

## Transmission, Substations and Distribution

*Hale's Bar Steam Plant on the Tennessee River.*—LOUIS R. LEE.—A plant designed for an ultimate capacity of 100,000 kw., of which 40,000 kw. is now installed, and for operation in connection with a large hydro-electric system, is described in considerable detail and illustrated. It is adjacent to a 45,000-kw. water-power station, and close to large deposits of high-grade coal that is delivered by river barge as well as by rail. The annual load factor is expected to be considerably below 50 per cent, a condition which calls for low investment per kilowatt capacity, but during periods of actual operation it will be high, therefore warranting the use of equipment giving high thermal efficiencies.—*Power Plant Engineering*, Dec. 1, 1924.

*French Rural Electrification.*—H. AMBROSE CARNEY.—Substation and line equipment is described and illustrated. Allusion is made to plowing demonstrations with a 24-hp. equipment consisting of a stationary carriage on which the motor is mounted and a wire-rope haulage so attached to a two-furrow plow that successive pairs of furrows can be plowed without shifting the motor. The energy consumption was 24 kw.-hr. per acre for a rough grass field which had not been previously been plowed, the furrows being 9 in. deep and the speed 100 ft. per minute. The equipment is stated to be comparable with a good oil tractor in price and service.—*Electrician (England)*, Nov. 14 and 21, 1924.

*Comparative Tests on Suspension Insulators.*—P. PERROCHET.—With a view in mind of standardizing one type from the many available suspension-type insulators now obtainable in the market, the Federal Swiss Electrical Society (S. E. V.), in collaboration with the Zurich University, conducted elaborate tests on a large number of various types of these insulators. The tests comprised dry and wet flashover voltage, puncture voltage under oil, mechanical strength and influence of rapid temperature changes. The two tests last named were combined with additional electric tests before and after. On account of the very severe (Alpine) climate of Switzerland, particular stress was laid upon the temperature tests. The insulators were warmed up to 70 deg. C. and subsequently plunged into water of 0 deg. C. After five such changes the insulator was tested electrically and mechanically. This complete cycle was repeated many times, some of the insulators standing up from 25 such cycles.—*Bulletin de l'Association Suisse des Electriciens*, November, 1924.

## Units, Measurements and Instruments

*Mathematical Theories for the Breakdown of Solid Insulation Materials.*—L. DREYFUS.—The present paper is a continuation of a previous paper on the same subject (May 3, 1924, issue). The author discusses different methods of testing insulation materials, especially with respect to the deviations from the Wagner canal theory which have been observed and which hitherto have been explained as field concentrations at the edges of the conductor.—*Teknisk Tidskrift (Sweden), Elektroteknik*, Nov. 1, 1924.

*Frequency-Changing Device.*—S. CHIBA.—The simple form of bridge circuit consisting of impedances is first shown, whereby the impressing of an electromotive force of one frequency across one diagonal causes an electromotive force of a higher frequency across the other diagonal under certain conditions. Numerous variations are then illustrated and briefly explained.—*Electrician (England)*, Nov. 21, 1924.

*Single-Element Oscillograph of Camera Size.*—J. W. LEGG.—The instrument here described and illustrated includes an especially small and light magnet weighing less than three ounces and made of a newly developed steel with unusually high retentive properties, a vibrator in a 0.032-in. air gap, a 4-volt incandescent lamp with straight-line filament, a set of vibrator resistances, provision for throwing the one vibrator into six different circuits, and an optical system which by means of a reflecting prism utilizes two sides of the box for the path of the ray between vibrator and film or screen. Deflections of 2½ in. can be obtained, and frequencies as high as 3,500 cycles can be observed among the harmonics of a wave. The instrument is expected to serve a field from which the three-element oscillograph is at present barred because of its size and cost.—*Electric Journal*, December, 1924.

## Illumination

*Studies in Illumination.*—L. R. THOMPSON, L. SCHARTZ, J. E. IVES and N. P. BRYAN.—An investigation has been made of the particular problems of illumination as they relate to post office work in general. In addition to this study an attempt has been made to determine the relationship between present conditions of illumination in the post offices and the vision of the post office employees and the relationship between various degrees of illu-

mination and efficiency. The survey extended over a period of about eight months. Measurements of the illumination, both artificial and natural, actually prevailing in two post offices were made, and tests with different lighting units under different intensities of illumination were carried on. This report contains 118 pages and gives very comprehensive data.—*Public Health Bulletin, No.* 140, *Washington, D. C.*

## Motors and Control

*Special Constant-Current Motor for Ship Auxiliaries.*—To provide the advantages of electric drive for winches and other auxiliaries, while avoiding the drawback which the inventor believes attaches to the constant-potential motor—namely, that it may not safely be stalled—a constant-current system has been devised. Coupled to the generator shaft is an exciter with a single armature but two sets of brushes in quadrature, main and auxiliary, and likewise two sets of field poles. The coils of the main poles carry the main current from the generator, while the auxiliary poles have a winding carrying an exciting current from the auxiliary brushes, a compensating winding in series with the generator field and a stabilizing winding carrying the main current but going in opposite directions around the two halves of the poles, these halves being set side by side longitudinally. The article is abstracted from a paper read by Gilbert Austin before the Institute of Engineers and Shipbuilders in Scotland on Nov. 18. — *Engineering* (*England*), Nov. 28, 1924.

## Heat Applications and Material Handling

*Electric Cooking and Heating.*—W. H. ALABASTER. — The results obtained by the author from recent tests of electric cooking appliances are described, along with criticisms of the construction and performance of such appliances. In the author's opinion, electric cooking will be readily adopted in Australia both in large and small dwellings, including flats, owing to the reasonable cost of energy as compared with gas and other fuel. Detailed tests conducted on ovens, hot plates and fireless cookers are given.—*Electrical Engineer of Australia and New Zealand,* October, 1924.

*Electric Cargo Winch for Shipboard Service.*—A. O. LOOMIS.—Methods of cargo handling are described, the conditions to which the winch is exposed and the service it must render are explained, and examples are given of actual installations from which it would appear that the electric winch has found favor particularly on Diesel-engine-driven ships. As to economy, it is found that about 1 lb. of oil, costing at $1 per barrel a little more than 0.3 cent, is needed per ton of cargo handled, while over ten times this amount was needed for handling by steam winches on vessels of the Hog Island class.—*Electric Journal,* December, 1924.

*Electric Heating of Sheet and Tin Mill Rolls.* — GORDON FOX. — Electric preheating of the finishing rolls of sheet and tin mills is a new development which has demonstrated its ability to eliminate the first-turn difficulties incident to cold rolls. By this means it is possible to put the rolls in midweek conditions before the mills are started, so that production may proceed at maximum rate. — *Blast Furnace and Steel Plant,* November, 1924.

*Electrical Cooking Appliances.* — P. HAUKAAS. — The central-station problems incidental to this type of load are discussed. Condensed statistical information is given on family consumption in different countries. The rate question and the selling price of appliances are also considered.—*Teknisk Ukeblad* (*Norway*), Nov. 11, 1924.

## Electrophysics, Electrochemistry and Batteries

*Magnetic and Electric Properties of Electrolytic Iron.* — M. FUKUDA. — The magnetic and electric properties of electrolytic iron and its alloys melted in vacuum and rolled into sheets are investigated. Testing by direct and alternating current, resistivity of samples, notes on magnetization of iron with alternating currents and a discussion of the results are among the subjects considered. — *Journal of Institute of Electrical Engineers of Japan,* No. 435.

*The Electro-Galvanizing Industry.*—SHERARD COWPER-COLES. — The early history of the electric process as a substitute for dipping of iron and steel in molten zinc is briefly reviewed, both as to its growing practical application and as to the technical improvements through which initial difficulties were overcome. The illustrations include views of plants and diagrams showing the layout and details of the regenerative system, in which the weakened electrolyte is recharged by passing through a filter bed bearing finely divided zinc. — *Electrician* (*England*), Nov. 28, 1924.

## Traction

*Steel and Electrical Engineering.*—SIR ROBERT HADFIELD. — The author first comments on the importance of electric power in the steel industry, citing as an instance the consumption in one firm, that of Hadfields, Ltd., which in one year during the war amounted to 54,000,000 kw.-hr. He then reviews the history of alloy steels, dwelling particularly upon manganese steel, and gives statistics regarding the service performed by one tramway junction, that at Fitzalan Square, Sheffield, made of that material. An aggregate of 137,000,000 tons of traffic during twelve years reduced the weight of a 1,005-lb. crossing by 137 lb. Aside from applications involving resistance to wear, others are mentioned which utilize the non-magnetic properties of the material. The article is to be continued.—*Electrician* (*England*), Nov. 28, 1924.

*Electric Street Railways in the Principal Scandinavian Cities.*—This issue is devoted to the subject of electric street railways in Scandinavia. The general information consists of descriptions of the present systems and the plans for extensions. The technical information consists of a discussion of the trolleys and a discussion of ground currents.—*Teknisk Tidskrift* (*Sweden*), *Elektroteknik,* Nov. 22, 1924.

## Telegraphy, Telephony, Radio and Signals

*Driving-Point Impedance of Two-Mesh Circuits.* — R. M. FOSTER. — The necessary and sufficient conditions that a driving-point impedance be realizable by means of a two-mesh circuit consisting of resistances, capacities and inductances are stated in terms of the four roots and four poles of the impedance. The roots and poles are the time coefficients of the free oscillations of the circuit with the driving branch closed and opened respectively. For each of the eleven possible networks formulas are given for the calculations of values of the elements from the assigned values of the roots and poles. —*Bell System Technical Journal,* Vol. III, No. 4.

*Inductive Interference with Communication Circuits.* — ALEXANDER RUSSELL.—This paper is in the nature of an introduction to the mathematical theory of the subject. A distinction is made between "radiation" and "induction," the former producing both electric and magnetic effects and being used in radio telegraphy. By making certain assumptions justified by experiments in radio, it is shown that the intensity of the radiation field falls off inversely as the distance and inversely as the wave length. It is pointed out that a balanced three-phase system produces both electric and magnetic rotary fields in its neighborhood, the amplitudes of which fall off as the inverse square of the distance. A three-phase, four-wire system, however, may produce serious interference with the telephone systems, even when the phases are balanced.—*Journal Institution of Electrical Engineers* (*England*), November, 1924.

## Miscellaneous

*Turning of Windmills Into the Wind.* —H. BAUDISCH.—To utilize windmills to the best advantage, as is desirable for generation of electric energy, it is necessary to place the wheel always directly into the wind. This is being accomplished on small wheels with a simple rudder vane and on large wheels by a small auxiliary wheel. The article gives very simple formulas for designing this rudder or auxiliary wheel of a size adequate to the size of the wheel. —*Elektrotechnik und Maschinenbau,* Oct. 19, 1924.

*Tanning with the Aid of Electricity.* —RUDOLF DITMAR.—An electro-osmotic process has recently been put into operation in several plants in Europe whereby the tanning time is reduced by half and the quality of the leather is improved as compared with results obtained without current treatment. The new process has diaphragms that do not allow the tanning material to reach the electrode, thereby avoiding unfavorable features of older electrical processes. The energy requirement is small. Direct current is used at 110 volts, 40 amp. to 50 amp., for thirty-five skins. This acts for about eight hours, which means a consumption of 0.08 kw. to 0.10 kw. per kilogram of finished leather for that length of time. Other advantages are mentioned. — *Chemical and Metallurgical Engineering,* Dec. 1, 1924.

# News of the Industry

## Underwood Bill Goes Over the Holidays

### Postponement of Action on Muscle Shoals Weakens Belief in Passage of Law Sponsored by Alabama Senator—Commission Plan Revived

OBSTRUCTION continued to delay the progress of the Underwood bill through the Senate last week, and when Congress adjourned over the holidays no vote had been taken, prognostications that the bill could not, after all, be passed began to be heard, and talk of a commission to inquire into the facts and recommend what action should be taken was rife. Such a commission has been proposed in amendments introduced by Senators Jones of Washington and Wadsworth of New York. It would be a reversion to the plan originally advocated by President Coolidge.

As Congress adjourned public ownership versus private ownership was argued. As this question presents wide opportunities for discussion, there is no predicting when the debate will be concluded, but it would not be surprising were definite action taken by the Senate shortly after reconvening in January. The decisive vote doubtless will come on the Jones amendment, which provides that the matter be referred to a commission instructed to report in December, 1925. The commission is to be composed of the Secretaries of War and Agriculture and a third person whom the President will name.

Senator Underwood managed to expedite matters somewhat by accepting several amendments to his bill. These would require the distribution of all power not needed for the manufacture of fertilizer, provide that a lease of the property cannot be transferred without approval of the President and that farmers be given preference in the sale of fertilizer, authorize leasing of the property either separately or as a whole, and stipulate that the lessee shall set aside "an adequate reserve fund" to cover depreciation and guarantee the government against loss.

#### Against State Regulation

After two days of debate the Senate accepted, by a vote of forty-one to twenty-nine, an amendment by Senator Walsh of Montana providing for federal regulation of power distributed in more than one state. The Walsh amendment served to put the Senate on record as being opposed to state regulation of a federal government corporation. As drawn, the bill provided for state regulation of power produced at Muscle Shoals by either a lessee or government corporation.

Senator Norris, who last week charged that the General Electric Company is the backbone of a trust that seeks to control the power and electrical industry of the country, made another speech in which he sought to back up that charge by reading into the record a long list of corporations which, he said, are controlled in whole or in part by the General Electric Company or its subsidiaries. Among these corporations was the Alabama Power Company. While no one probably will be sufficiently interested to make the point on the floor, it is a matter of common knowledge that the ownership of the Alabama Power Company is entirely independent of the General Electric Company or the Electric Bond & Share Company. The majority of the stock is owned in Alabama. The Electric Bond & Share Company owns less than 20 per cent of the Alabama Power Company's common stock. No one interest controls the Alabama company, though it is true that there are three of the directors of the Electric Bond & Share Company on its board. This often occurs, it is pointed out, in the absence of actual control.

Senators Johnson of California and Shipstead of Minnesota supported Senator Norris, the latter declaring that the General Electric Company, backed by J. P. Morgan & Company, was scheming to get possession of Muscle Shoals by means of the Underwood bill. Senator Heflin of Alabama, on the other hand, declared that if Senator Norris was allowed to carry out his "dream" it would create "one of the greatest power trusts in the world." The Norris bill, Senator Heflin asserted, is "a power bill solely."

The editorial printed in the Washington *Herald* and other papers owned by W. R. Hearst was denounced by the Senate investigating committee as "neither fair nor honest," and Senator Underwood was cleared of any aspersions.

## New York State Discontinues Water-Power Suit

It is announced by Attorney-General Carl Sherman that the State of New York has discontinued its suit against the United States instituted during the administration of Attorney-General Newton for the purpose of testing the powers of the Federal Power Commission under the Esch water-power law. The stipulation discontinuing the action is in conformity with an agreement made with Solicitor-General Beck of the United States more than a year ago, when, following a conference between representatives of the state and federal power commissions the state's legal representatives concluded that there was no actual conflict between the state and federal governments and at the request of the state the Solicitor-General refrained from pressing the suit for argument.

Attorney-General Sherman points out that the suit is not discontinued upon its merits, but that the state can renew it at any time. The facts were called to the attention of Attorney-General-elect Ottinger, who indicated that he had no objection to this action being taken since he will be free to deal with the situation should he desire to revive the suit. Mr. Sherman said:

"I agreed to discontinue this suit because I felt the state could not have a test of these important questions in view of the attitude of the present federal officers, who have taken no action which may be regarded as an infringement of the state's rights in its waters and in conference substantially conceded the state's claims. It is unfortunate that the relative powers of the state and federal authorities with respect to water power cannot now be determined. The conflict of interests is almost inevitable, but I am firmly convinced the state should be in a position to present its strongest case when it seeks its day in court."

## Des Moines and Tecumseh Plants Ready in 1925

Further details concerning the two large steam stations now being built by the Illinois Power & Light Corporation, one, known as the Balls Ford power station, at Des Moines, Iowa, and the other near Topeka, Kan., have been announced. Both stations will be completed and in operation in 1925.

The Iowa station, which is being built by the Iowa Power & Light Company, a subsidiary of the Des Moines Electric Light Company, will occupy a site of 63 acres on the outskirts of Des Moines below the junction of the Des Moines and Raccoon Rivers, thus being assured of an ample supply of water for condensing. The initial capacity of this station will be 60,000 kva., the two units now being constructed being rated at 25,000 kva. and 35,000 kva. respectively. The planned ultimate capacity of the station is 165 000 kva., to be reached, as the demands of the territory served require, by the installation of additional units from time to time, possibly of 35,000 kva. each. The turbo-generators now being built will have a full equipment of boilers, automatic stokers, coal-handling equipment, fans for forced and induced draft, boiler-feed pumps, electrical switching equipment and all necessary auxiliaries. Essential auxiliary equipment will be in duplicate to assure continuity of service. Steam will be generated at 375 lb. pressure and with a total temperature of 680 degrees Fahr. Two stacks each 16 ft. in diameter by 200 ft. high will be built with the first installation. Subaqueous coal storage

for 50,000 tons is provided, with plans for the expansion of the storage pit to a capacity of 150,000 tons. The annual fuel requirements of the station as now being built will be 200,000 tons. When completed to its full contemplated capacity these requirements will reach 650,000 tons annually.

The plant of the Kansas Power & Light Company, a subsidiary of the Kansas Public Service Company, is being built on the bank of the Kaw River at Tecumseh, 6 miles from Topeka, and it will have an initial installed capacity of 15,000 kva., with an ultimate planned capacity of 75,000 kva. A 66,000-volt steel-tower transmission line is under construction between the plant and Atchison, a distance of 54 miles, to serve that city and intervening territory. The plant when finished will furnish electrical energy to a large section of northeastern Kansas.

# Pennsylvania's "Giant Power Survey"

## Governor Pinchot's Advisory Board Urges State Co-operation with the Interconnection Developments Being Carried Out by the Electrical Industry

IN A LETTER to Governor Gifford Pinchot under date of December 15, General William Crozier, chairman of the advisory committee of the "Giant Power Survey" of the State of Pennsylvania, makes for that committee comment and suggestion with reference to the forthcoming report of the Giant Power Survey Board. In this letter the committee commends the state for its far-sightedness in making a study which will assure the commonwealth that electric power development and interconnection shall proceed without economic waste and without acrimony between private industry and the public. It makes strong recommendation that the best way to attain the desired result is to give the fullest and most sympathetic support and co-operation to the electrical industry, which has for some time been actually proceeding with interconnection, and also to work in co-operation with neighboring states and the rest of the nation.

The advisory committee, it will be recalled, was constituted by Governor Pinchot in order that he might have the advice of a group representative of opinion from different parts of the United States and in various walks of life, all interested in power development. The committee says that it has studied preliminary drafts of the report of the Giant Power Survey, of which Morris L. Cooke is the director, and that it is making its comments and recommendations in light of the fact that the electrical industry now supplies a prime public necessity and with the knowledge that it is necessary to develop it most effectively for the community as a whole.

### The Committee's Letter

The letter itself follows in full:

"Your committee, appointed to advise you in regard to the work of the Giant Power Survey authorized by act of the Pennsylvania Legislature, has met in New York City and has listened to an explanation of the Giant Power program by the director of the survey, Morris L. Cooke. Preceding the meeting, certain sub-committees had read the preliminary drafts of some of the sections of the report of the Giant Power Board, covering technical and legal phases of the work, and had submitted comment upon these sections. In connection with the explanation of the director there was a discussion of the subject in committee to the extent which was permitted by the time available.

"At the outset it can be stated that the advisory committee is strongly of the opinion that there should be a program, which should cover as well as the present state of knowledge permits the development of the electrical industry. This industry now supplies a public necessity comparable with the need for transportation, for water supply or for any other fundamental requirement of civilization, and the committee believes that the Legislature of Pennsylvania has performed a distinct public service in providing for an inquiry which may lead to the establishment of such a program.

### Two Aspects of Inquiry

"We think that this inquiry presents two aspects which are of general interest and outstanding importance. The first is the relation of the project initiated by the State of Pennsylvania to the nation as a whole and especially to the neighboring states. The second is its relation to the enormous and rapidly developing electrical industry of the country.

"In the first place, your committee believes that in this country we are on the threshold of a development in the use of electric power which is comparable only to the development of steam power during the nineteenth century. This development is being made feasible by the possibility of transmission of electric current over long distances, not only into the factory and the workshop, but into the home and on to the farm. In providing for a survey of the future of this development upon lines which shall be far-sighted, economical and in the public interest, the State of Pennsylvania is taking a step which is not only of interest to the rest of the country, but which can only attain the fullest success by the co-operation of the whole nation. We think that it is of the highest importance that this development should proceed without the economic waste, the rivalry between different jurisdictions and the acrimony between private industry and the public which formerly characterized a similar development in the case of our railroads.

"It is manifest that this cannot be done unless there is, so far as possible, harmony of purpose and of method throughout the country. On the other hand, it is equally manifest that to throw upon the national government the burden of regulating the details of such a development, in addition to the other activities already exercised by it, would involve overcentralization and evils of bureaucratic control which should be avoided if another solution can be found. Unlike the situation which existed at the time when our railroad development was beginning, most of the states now have systems of public service commissions and other agencies for exercising the necessary control over public utilities, and your committee believes that a solution by co-ordination of the already existing state agencies, if possible, would be preferable to centralized federal regulation.

"For this reason, we think that such a project as that which Pennsylvania has embarked upon should meet with the approval and co-operation of every far-sighted citizen, and particularly of those intrusted with the management of the affairs of its neighboring commonwealths. The economic possibilities of electrical development are not confined within the artificial boundaries of the states, and it is only by co-operation that harmonious regulation can be instituted and consequently full development be attained.

### Commends Pennsylvania Plan

"The first step toward ascertaining whether the co-operation is possible is for some commonwealth like Pennsylvania to undertake to make such a survey and plan as has now been authorized and is being formulated.

"In the second place, we have witnessed since the war a marked development on the part of the electrical industry itself in the direction of obtaining economies of operation and completeness of service by interconnection between different systems. More and more the leaders of the industry are recognizing the problem which is upon us and are seeking, by foresight within the industry, to secure those advantages which accompany the covering of a considerable territory with a system which enables all parts of the territory to pool the resources to be found within its boundaries.

"Natural growth under this leadership would probably in the end bring about a unification of plan and an eventual utilization of the best method of generating, transmitting and distributing electric current; but this result would only be attained at the cost, on the way, of many installations of an unsatisfactory character and size which might have been avoided could the broad lines of the final development have been considered and insisted upon from the beginning.

"We think that it is a proper function of the state to provide such a comprehensive view of the problem and to insist that expenditures should, so far as possible, conform to an ultimately complete general plan rather than merely to meet the immediate exigencies of corporations serving restricted localities.

"The state cannot command any greater expert knowledge than is employed by the industry, but it *can* sup-

ply a broader view and the power to insist upon the adoption of the ultimate, rather than the immediate, objective. We think that this leadership of the state, however, should be exercised only with the fullest recognition of the progressive tendencies on the part of the industry itself which differentiate the present situation in the electrical world from a corresponding stage in the evolution of many other services. We see no reason why anything but the fullest and most sympathetic co-operation between the state and the industry should exist, and we believe that the public interest requires such co-operation.

"Your committee believes, therefore, that the beginning which is being made by the State of Pennsylvania should be followed up, and that the good start which has been had in the effort to guide properly and with forethought this great development should be pursued in such manner as to keep the subject prominently before the people of the state and of the nation."

Aside from General Crozier, one of the most active members of the advisory committee and one of the most serious students of the entire problem has been Colonel Henry L. Stimson, former Secretary of War. The entire committee personnel is as follows:

William Crozier, major general, U. S. A., late Chief of Ordinance, chairman.
Robert P. Bass, former Governor of New Hampshire.
Martha Bensley Bruere, writer, New York City.
Arthur P. Davis, former director United States Reclamation Service, Oakland, Cal.
Charles W. Eliot, president emeritus Harvard University, Cambridge.
Irving Fisher, professor of political economy, Yale University, New Haven.
John R. Freeman, consulting engineer, Providence, R. I.
Frederick A. Gaby, chief engineer Hydro-Electric Power Commission of Ontario, Toronto.
Harry A. Garfield, president Williams College, Williamstown, Mass.
James R. Garfield, attorney, former Secretary of the Interior, Cleveland.
Samuel Gompers, late president American Federation of Labor, Washington.*
Casper F. Goodrich, rear admiral, U. S. N., Princeton, N. J.
Henry S. Graves, dean School of Forestry, Yale University, New Haven.
William Kent, former Representative in Congress, Kentfield, Cal.
Fred R. Low, editor of *Power* and late president A. S. M. E., New York.
Arthur J. Mason, Chicago, Ill.
William B. Mayo, chief engineer to Henry Ford, Detroit.
Charles E. Merriam, professor of political science, University of Chicago.
Arthur E. Morgan, civil engineer, Dayton, Ohio.
William Mulholland, chief engineer Las Angeles Water Department.
George W. Norris, governor Federal Reserve Bank, Philadelphia.
George Foster Peabody, banker, New York City.
Maud Wood Park, president National League of Women Voters, Washington.
Joseph Hyde Pratt, state geologist, Chapel Hill, N. C.
Herbert Quick, author, Berkeley Springs, W. Va.
Leo S. Rowe, professor of political science, Washington.
E. F. Scattergood, chief electrical engineer Los Angeles Electrical Department.
Herbert Knox Smith, attorney, Hartford.
Raymond B. Stevens, Representative in Congress, Lisbon, N. H.
Henry L. Stimson, attorney, former Secretary of War, New York City.
Francis Lee Stuart, consulting engineer, New York City.
Joseph N. Teal, attorney, Portland, Ore.
William S. Twining, consulting engineer, Philadelphia.
William Allen White, editor and author, Emporia, Kan.

*Deceased.

## Public and Private Rates

### Interesting Comparison of Charges for Energy in Montreal and Toronto

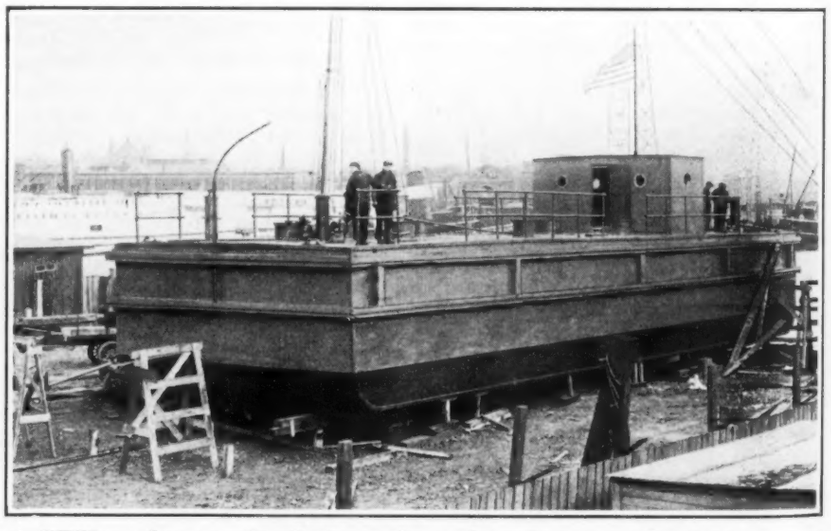
MONTREAL gets all its power from one company, the Montreal Light, Heat & Power Consolidated, which also operates what was formerly a competing company. Toronto gets its power and light from the city-owned Toronto Hydro-Electric Commission. Household rates in Montreal are higher than in Toronto, and a demand has been made in the former city by newspapers and some civic organizations that the company's rates be lowered. Those making this demand do not take into consideration the rates paid by large power users, which in Toronto are high enough to counterbalance service at less than cost to domestic consumers. The Montreal company endeavors to equalize power and lighting charges between small and large consumers according to the cost of distribution, and a recent comparison put forth in its behalf shows that in 1922 there was a difference of more than one-third of a cent per kilowatt-hour in the average rates in Montreal and Toronto. In 1923 the difference was over half a cent per kilowatt-hour in favor of Montreal. The actual comparison in 1923 is given as follows:

| | Montreal | Toronto |
|---|---|---|
| Gross revenue | $8,908,003.11 | $7,085,172.17 |
| Less taxes | 600,224.35 | ..... |
| Net | $8,307,778.76 | $7,085,172.17 |
| Output, kw.-hr. | 678,455,296 | 392,367,546 |
| Return per kw.-hr., cents | 1.224 | 1.80 |

It should be explained that the Montreal company's revenue, as given, does not include power sold for export to the United States, as this is sold at a rate that is admittedly too low to be fairly compared with Toronto. The Montreal figures have also been adjusted to allow for federal, provincial and municipal taxes on the electric system, as the Toronto system pays no revenues to the people in taxation. The data are based on average rates, calculated in the case of Montreal from the records of the Montreal Light, Heat & Power Consolidated and in the case of Toronto from the published annual reports of the Hydro Commission of that city.

The Montreal figures include the revenue from power sold at wholesale to the cities of Westmount and St. Lambert. Naturally the citizens of these communities pay more for their power than is received by the company. However, this is said to be the only visible factor that makes the figures at all unfair, and its correction would not alter the proportions more than a trifle.

## First "One-Piece" Vessel Welded by Electricity



A FEW weeks ago the first vessel ever built in the United States by the electric welding method was launched at Providence, R. I. Its construction was of much interest to electrical engineers and shipbuilders as it was put together without the use of a single rivet in the plates of the hull or a bolt in its steel frame. The frame and the plates of $\frac{3}{16}$-in. steel are joined together at all points of contact by welding into a hull virtually all one fabric. Steel deck and steel wheelhouse are also a part of an indivisible whole.

The barge was entirely constructed by the electric arc welding method, using three General Electric welding equipments. One was used for tacking with a fitting-up crew and the other two for welding. The largest number of men employed at any one time was six. The builder, the Saxe Providence Boiler Works, estimates that had the barge been constructed in the ordinary riveting manner, a force of eighteen men would have been required. A further comparison, based on a record of costs, shows that, excluding the costs common to both methods, two electrically welded barges could have been built for the price of one riveted barge.

The Independent, as the tanker has been named by the Pennsylvania Petroleum Products Company, which will use it for transporting oil, is built around two cylindrical oil tanks 8 ft. in diameter and 67 ft. long each having a capacity of 26,000 gal. The total weight of barge and tanks is 70 tons.

## Rural Service on Coast

**Progress of California Committee on Relation of Electricity to Agriculture**

THE proposed work of the California Committee on the Relation of Electricity to Agriculture, as outlined by Chairman L. J. Fletcher at the recent meeting of the Commercial National Section, N. E. L. A., at San Rafael, Cal., indicated very satisfactory progress. Mr. Fletcher is a professor in the agricultural engineering division of the University of California, and Prof. B. D. Moses of the same institution acts as executive secretary of the committee.

The committee declared its objects to be to find and give publicity to all of the efficient ways of utilizing electrical energy on California farms, to obtain data concerning present uses of electricity in the agriculture of the state, and to carry out investigations based on new uses for electrical energy on the farm. Four general project committees have been organized whose respective duties will be: (1) to acquire actual and comparative costs and other data concerning present uses and to get information on kinds and number of uses, amount of electricity used, hours and time of use, load factors, cost of equipment, power requirements, efficiency and any other data which will aid in determining the present economic uses of electrical energy; (2) to study the development of contracts and rate making as an aid to other states; (3) to make a complete investigation of the uses of electricity and the ways in which it will improve lighting conditions, lighten the work in the farm home and, in general, bring the conveniences now enjoyed in the city home; (4) to make a study of the ways in which present utilization may be improved, especially as it is applied to production, and to study how electrical energy compares in cost and service with other types of energy and the possibilities of manufacturing on the farm.

Committee No. 1 has prepared two sets of questionnaires, one to be answered by power companies themselves, the second to be mailed to all agricultural electric customers in California with a view of determining the size and character of individual installations and applications, including the extent to which homes are equipped with ranges, water heaters and other appliances, as well as the size and capacity of the irrigation pumps, motor-driven feed cutters, silo fillers, shop motors, grinders, etc. Committee No. 2 has already begun work on studies of the rate-making methods employed by California utilities and on the contract forms used by rural consumers. The work of committee No. 3 is divided into four classes, and a study will be made of the extent to which electrical energy is used for cooking, water heating, washing, cleaning and other domestic services, its application to refrigeration, heating and ventilation, and water supply. The investigations of committee No. 4 will deal with pumping for irrigation, finishing and processing of farm products and dehydration, poultry equipment, dairy-farm equipment, power for the farm shop, portable motors and the development of portable transformers, farm refrigeration and stationary spraying.

The investigations in California, which has perhaps advanced further than any other state along rural service lines, will, it is thought, be of great benefit to similar committees in the Middle West, the South and the East, where rural electrification is yet in its infancy.

## Meriden Company Bought by Connecticut Light & Power

Interests identified with the Connecticut Light & Power Company of Waterbury, Conn., have acquired the Meriden Electric Light Company and the Meriden Gas Light Company. The total capitalization of the Meriden companies is $1,750,000, with no funded or floating debt. The assets of the electric light company are valued at $1,717,066 and those of the gas company at $2,101,473.

Irvin W. Day, vice-president of the Connecticut Light & Power Company, informs the ELECTRICAL WORLD that it is planned to take over the management of the Meriden properties on January 20. The system of the electric light company will be connected with the 66,000-volt transmission lines of the Connecticut Light & Power Company, the plant will be enlarged and the Meriden company put in a position to supply all the available power load in that section.

## Applications Before Federal Power Commission

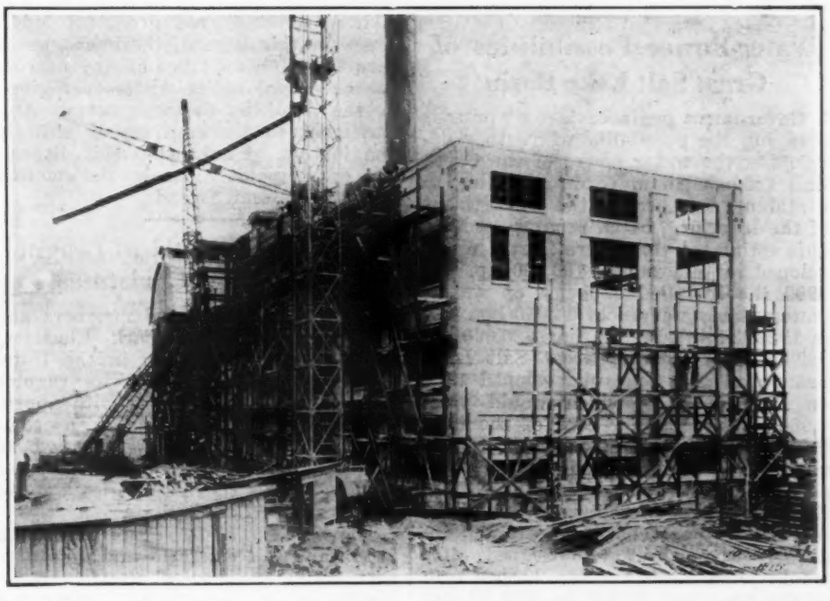
William C. McCowan has applied to the Federal Power Commission for a preliminary permit covering a project on the Kern River in California. He desires to store floodwaters in the Isabella reservoir and to drop the water through existing power houses on Kern River to the irrigated lands south of Bakersfield. The application conflicts with that of the Kern River Water Storage District.

The city of Lewiston, Idaho, has applied for a preliminary permit covering a project on the Clearwater River, near Spalding. The purpose is to construct a dam 30 ft. in height and the appurtenant power structures. This will make possible the development of 2,500 hp. The power is to be used for public utility purposes.

The Kentucky Hydro-Electric Company has applied for a preliminary permit covering a project on the South Fork of the Kentucky River. This involves the erection of a dam 160 ft. high one mile above Booneville.

The Interstate Public Service Company has applied for a preliminary permit covering a 4,200-hp. project on the St. Joseph's River, near the Indiana-Michigan boundary. The Inland Power & Light Company has applied for a license to cover a transmission line in Denton County, Wash.

## Oregon Mill-Refuse Plant Nearing Completion



THE new steam-electric plant of the Mountain States Power Company near North Bend, Ore., is rapidly nearing completion and will be ready for operation before the new year. Built on the unit system, with a temporary tile wall on one side to permit enlargement, the plant will start with a capacity of 6,700 hp. and can be increased to an ultimate capacity of 40,000 hp. The initial installation will take care of the present demand, while the final program is intended for a city with a population of 150,000.

The plant will consist of three main buildings, the power plant proper, the fuel-storage department and the fuel-unloading tower. Mill refuse is to be burned as fuel; it will be delivered in barges to storage and thence carried by conveyors to the boilers, eliminating stoking by hand. Condenser water for the turbines is drawn from Coos Bay; boiler-feed water comes from the regular city supply.

Construction work began in April, 1924, under the direction of George F. Phythian, construction superintendent for the Byllesby Engineering & Management Corporation. A. L. Martin is local manager of the Mountain States Company.

## Associated Gas & Electric to Get Portsmouth Utility

The Associated Gas & Electric Company of New York has arranged to acquire, subject to verification of certain representations set forth in the purchase agreement, the outstanding preferred and common stocks of the New Hampshire Electric Railways, which controls the Rockingham County Light & Power Company of Portsmouth, N. H., and other utility properties. The asset value of the properties to be taken over by the New York company exceeds $11,000,000. An offer of $32 a share for the preferred shares and $3 for the common has been submitted to the stockholders by a committee, which states that it acts at the request of the owners of a majority of both the common and preferred shares.

The Portsmouth Power Company does the entire lighting and power business in Portsmouth and the towns of New Castle, Rye, North Hampton, Greenland, Newington, Newfields, Epping, Newmarket and Durham in New Hampshire. Through a ninety-nine-year lease of the property of the Kittery Electric Light Company the Portsmouth company also does the lighting and power business of Kittery and Eliot in Maine. It also furnishes power at wholesale to the Twin States Gas & Electric Company and other light and power companies in contiguous territory, besides supplying power to street railways operating 126 miles of electric railway in Massachusetts and New Hampshire.

## Water-Power Possibilities of Great Salt Lake Basin

Government engineers are at present studying the possibility of further developing the water power of the Great Salt Lake basin in Utah, according to a statement issued by the Department of the Interior. From reports received it is estimated that there is still undeveloped in this region 100,000 hp. In 1900 the installed capacity of water-power plants was about 14,000 hp., and in 1923 it totaled more than 225,000 hp.

The report on the Great Salt Lake basin describes four undeveloped sites on Spanish Fork which would yield 8,900 hp. for 90 per cent of the time and 11,700 hp. for 50 per cent of the time. Three other undeveloped sites on Logan River would yield 11,400 hp. for 90 per cent of the time and 19,300 hp. for 50 per cent of the time. On Weber River four undeveloped sites would yield 9,150 hp. for 90 per cent of the time and 11,600 hp. for 50 per cent of the time. These estimates are based on the present flow, unregulated. On Bear River, with regulated flow, four undeveloped sites would yield 21,000 hp. for 90 per cent of the time and 30,000 hp. for 50 per cent of the time.

The total capacity of undeveloped sites in the Great Salt Lake basin is 81,000 hp. for 50 per cent of the time and 56,000 hp. for 90 per cent of the time with existing flow and 115,000 hp. for 50 per cent of the time and 80,000 hp. for 90 per cent of the time with regulated flow. Developed and undeveloped sites in the basin are described in the report, which also gives such information relative to the use of water in irrigation and to the market for power as will afford a basis for a correct estimate of the present and future value of the water-power resources of the basin and of the possibilities for profitable water-power development.

## French Scientists Do Not Back Dussaud's "Cold Light"

There recently appeared in a number of American papers, all associated under one well-known management, an account of a discovery of "cold light" by M. Dussaud, in France, with the implication that the announcement was made under the authority of the French Academy of Sciences.

The director of the Ecole Supérieure d'Electricité, who is also a member of the French Institute, disposes of the inferred claim of M. Dussaud in a letter of which the following is a translation:

"I regret, as you do, that the name of the Academy of Sciences has been mixed up in America with a bold advertising claim of such serious import. The reply to that is that the Academy never has announced the pretended discoveries of Dussaud. There were in 1911 certain notes of this gentleman which were allowed to pass to the 'Comptes Rendus' [minutes]—it was, I believe, Mr. Branly who presented two of them and the third was addressed directly to the permanent secretaries. But if he at that time was allowed to enjoy too great an indulgence in this regard, there has never been the slightest trace of any patronage or official notice whatsoever given by the Academy to these notes. Any statement to the contrary is entirely imaginative. I hope that this disposition of the point will calm the emotion of our American friends."

## New York Electrical League Celebrates Christmas

More than a thousand members and guests of the New York Electrical League met at luncheon in the Hotel Astor on Wednesday for its regular Christmas celebration and with appropriate ceremonies dedicated a community Christmas tree, which has been installed in Times Square, the center of New York's theater district and the heart of the "Great White Way."

The tree is a 50-ft. spruce erected on an ornamental platform and decorated with 1,500 multi-color electric lights. Hidden in the branches of the tree is a set of radio amplifiers connected with microphones installed in the Hotel Astor ballroom. The dedication and the singing of carols were broadcasted to Times Square. A service of Christmas carols was also broadcasted from the tree on Christmas Eve, and the music from the hotel will be audible to the throngs on the street throughout the holiday week.

President Walter Drury presided over the dedication ceremonies and luncheon festivities, which included the distribution of gifts by a corps of Santa Clauses.

## Power Board Questions

### Proper Location of Conowingo Dam—Diversion of River Courses—Lawyers Unnecessary

STUDY of the plans submitted in connection with the application of the Susquehanna Power Company to the Federal Power Commission for a license covering its Conowingo (Md.) project has raised a question as to whether a dam at Conowingo will permit of complete use of the flow available. The dam is not located at tidewater, while at the same time it is not far enough up the stream to permit of another dam below it. Full utilization of the power resources of the Susquehanna could be made were the dam built at Fort Deposit, instead of at the proposed site, which is several miles above. The Fort Deposit site, however, is complicated by the necessity for relocating the railroad. The expense involved in that undertaking might be more than the additional power would be worth. The matter has been referred to the district engineer for a report. The application for a license will not be brought before the commission itself until after the first of the year.

The plans provide for no fishway, although the dam at McCall's Ferry above is so equipped. It is understood, however, that a check covering an extended period at McCall's Ferry indicates that almost no use of the fishway is made by the fish. For that reason it is probable that the company can justify a contention that the additional expenditure is not warranted in the interest of fish preservation.

#### DIVERSION OF RIVER COURSES

The diversion proposed in the application of the Central Power Company of Albemarle, N. C. (noted November 15, page 1068) will, as then stated, turn water which naturally goes to the sea by the way of the Mississippi Valley watershed on to the other side of the divide, where it will flow into the Atlantic. No information is available as to the effect of such diversion. This instance will be cited by Congressmen as an example of the need for comprehensive river studies. In the course of water-power development there will be many instances in which diversion will be desirable to increase power capacity. Since the course of rivers cannot be changed without the possibility of far-reaching effects, there should be a general study of all rivers, it is argued, so that delays in granting such applications as that of the Central Power Company may be avoided in the future.

Attention is being called to the fact that negotiations with the Federal Power Commission usually do not require the services of an attorney. Most of the transactions with the commission must be reduced to writing for matters of record, and delay only results when this correspondence must be carried on through a representative of the party at interest. There have been recent instances in which persons with nothing more than routine business to transact have been of the opinion that it was necessary to employ a person on the ground for that purpose.

# Briefer News

**New Central-Station Office Building for Davenport, Iowa.** — The United Light & Power Company is to erect a five-story brick office building at Second and Perry Streets, Davenport, Iowa, at an immediate expenditure of $500,000, with plans for its enlargement and for three additional stories, at an ultimate cost of $2,000,000.

**Puget Sound Company Acquires Anacortes Plant.**—The Puget Sound Power & Light Company announces the acquisition of the Washington Power & Light Company of Anacortes, Wash., which will be operated under the Northern District of the Puget Sound company. The transfer of the property was celebrated by a banquet in Anacortes at which the city officials and officers of the company spoke.

**"Regional Meetings" of Institute.**— In addition to the national conventions of the American Institute of Electrical Engineers for 1925, already announced, three "regional meetings" have been authorized under the auspices of the officers and committees of the geographical districts in which these meetings are scheduled, as follows: January 23-24, Washington; May (early), Swampscott, Mass.; May 22-23, Cleveland.

**Another Effort to Repeal Tennessee's Utility Commission Law.** — Another effort to repeal the law establishing the Railroad and Public Utilities Commission of Tennessee will be made when the State Legislature meets early in the new year. A number of legislators have been instructed so to vote. The existing commission has three members, whose terms expire on January 1, 1925, 1927 and 1929 respectively.

**Panama Municipal-Plant Bill Thought Dead.**—The President of Panama has vetoed the legislative bill referred to last week on page 1326 which authorized Panama City to construct and operate a municipal light and power plant in competition with the Panama Power & Light Company, financed in the United States. It is not thought that any attempt to repass the bill over the veto will be made.

**St. Joseph Accepts Doherty's Street-Lighting Proposal.**—Following the rejection by the voters of St. Joseph, Mo., of a proposed bond issue for the rehabilitation of the municipal plant, as noted in the ELECTRICAL WORLD for November 22, page 1118, a special election was held on December 16 to submit the proposal of Henry L. Doherty to furnish the electrical energy for the street-lighting system. This proposal was carried by a majority of more than two to one, or substantially the same vote by which the municipal bond issue was defeated.

**Washita River Once More Generating Energy.**—The reconstructed and enlarged hydro-electric power plant of the Chickasha Gas & Electric Company, 4 miles below Chickasha, Okla., on the Washita River, is now in operation. A third turbine, as large as the two formerly installed, has been added to the plant, giving it a capacity of about 1,300 kw. The old plant was put out of commission when the 1923 floods cut a new channel around the company's dam and left the plant "high and dry."

**Wilson Dam in Text and Picture.**— "Electric Power from the Tennessee River," which is "Construction Progress Bulletin No. 2," issued by Hugh L. Cooper & Company, designing and supervising engineers for the entire Wilson Dam development at Muscle Shoals, contains twenty-six halftones, six drawings and a map, all about 10 in. x 6 in., together with explanatory text. The publication is one of no ordinary value from an artistic as well as a technical point of view and gives undoubtedly the best and clearest idea of the tremendous structure built by the government in the Tennessee that has yet been or is likely to be issued.

**Brooklyn Women Employees Hear About Public Relations.** — Under the guidance of a committee headed by Miss Anne Lincoln, the hundreds of women employed by the Brooklyn Edison Company gathered in the auditorium of the company's building on December 10 to listen to talks by Miss R. E. McKee, chairman of the women's public information committee of the National Electric Light Association, and Miss Mary E. Dillon, chairman of a similar committee of the Empire State Gas and Electric Association. The former discussed the employee's duty in promoting good public relations, and the latter the opportunities that public utility companies offer to women.

## Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

New England Electrical Credit Association—Boston, Jan. 13. C. A. Kane, 99 Bedford St., Boston.

Kentucky Association of Public Utilities—Louisville, Jan. 15-16. E. F. Kelley, Louisville Railway Co., Louisville.

American Engineering Council—Washington, Jan. 16-17. L. W. Wallace, 26 Jackson Place Washington, D. C.

Electrical Safety Conference — New York, Jan. 21. R. B. Shepard, 109 Leonard St., New York.

Western Association of Electrical Inspectors — Brown Hotel, Louisville, Ky., Jan. 27-29. G. M. Miller, 1304 South Seventh St., Louisville.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 28-30. H. M. Northrup, 23 Erie St., Milwaukee.

New Mexico Electrical Association—Albuquerque, N. M., Feb. 16-18, Bernard L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

American Institute of Electrical Engineers—New York, Feb. 9-12; St. Louis, April 13-17; Saratoga, N. Y., June 22-26. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mining and Metallurgical Engineers—New York, Feb. 16-19. F. F. Sharpless, 29 West 39th St., New York.

Wisconsin Chapter of Electrical Inspectors—Pfister Hotel, Milwaukee, Feb. 17-19. A. C. Schultz, Milwaukee.

**Iowa Rural Service System Sold.**— The sale of the Hawkeye Electric Power Company, with headquarters in Davenport, Iowa, to John A. Reed of Cedar Rapids, owner of the Iowa Electric Company and the Iowa Falls Electric Company, is announced. The Hawkeye Electric Power Company supplies rural users in Long Grove, McCausland and other places in Scott County; Lost Nation, Goose Lake, Low Moor and other places in Clinton County and a number of towns in Jackson County.

**Continental-United Company Projects Big Plant on Missouri River.**— The construction of an electric generating station of large capacity at Plattsmouth, Neb., on the Missouri River, is under consideration by the United Light & Power Company, of which the Continental Gas & Electric Corporation now forms part. It will undoubtedly be a steam plant, and its location on the riverbank will be prompted by the abundance of water for the purpose of cooling the turbines rather than by any hope of obtaining water power from the river.

**Directorate of Boston Electrical League Named.**—The following directors have been elected by the Metropolitan Electrical League of Boston, in addition to the officers named in the ELECTRICAL WORLD of November 29, page 1174: For one year, F. S. Price, George H. Cox, O. L. Hawes, F. H. Golding; for two years, George H. Wahn, T. S. Knight, Frank Wigglesworth, F. L. Barnes, Edward Dana, F. M. Gunby; for three years, W. H. Atkins, Karl L. Norris, E. W. Longley, H. B. Gilmore, Chester T. Bliss and Henry D. Sears.

**Loveland, Col., Cannot Condemn Distribution System of Private Company.**— The city of Loveland, Col., has been forbidden by the District Court to attempt to condemn the distribution system in that city of the Public Service Company of Colorado, which Loveland desires to obtain and use for the sale of the energy to be generated at its new municipal plant. The city desired to take over the lines and let the court fix the price to be paid, but the court has decreed that the system can be acquired only by negotiated purchase from the company.

**Additions to Insull Properties in Indiana.**—The Indianapolis Public Service Commission has given permission to four Indiana utility companies controlled by the Insull interests to absorb smaller companies to the number of twelve in all. The Northern Indiana Electric Company will pay $144,661 for plants at Akron, Chili, Denver, Mexico, Whitestown, Sedalia and Larwill and a plant of the Farmers' Mutual Light and Power Association. The Wabash Valley Electric Company will pay

$7,500 for the Fillmore light and power system. The Merchants' Heat & Light Company of Indianapolis will buy the Amo plant for $8,000, and the Indiana Electric Corporation will purchase the Carthage and Charlottesville plants at $32,400.

**Adventurous Cat Climbs Pole and Short-Circuits Wires.**—Short-circuits of high-tension wires caused by birds and squirrels are not unusual, but the domesticated cat has not usually been regarded with suspicion. Yet a cat climbed a pole at the Great Western Power Company's substation at Clayton, Cal., recently and "shorted" two of the wires. A flareback resulted, causing a fire which damaged the station to the extent of $25,000. The charred body of the cat at the foot of the pole pointed clearly to the incendiary.

**War Department to Confer with Technical Men.**—Representatives of a number of technical societies and trade associations have been invited by Secretary of War Weeks to meet War Department officials and civilian advisers in Washington January 16 in a conference regarding the construction policy of the department both in the event of a war emergency and in times of peace. The conference is believed to foreshadow a policy of unified control of all matters relating to construction works by the military branches of the War Department. The American Institute of Electrical Engineers and the other national technical societies are among those invited to send representatives.

**Albert Emanuel Company Buys Additional Properties in Arkansas.**—Three electric light properties in northwestern Arkansas—the Fayetteville Gas & Electric Company, the Springdale Light & Power Company and the Rogers Light & Water Company, have been purchased by the Albert Emanuel Company of New York and added to the system of the Southwest Power Company, which under its own name serves twenty communities in eastern Oklahoma and western Arkansas. Consolidated with the Southwest Power Company are also the Intercounty Power & Light Company, serving Carroll and Boone Counties, Ark., and the Southwestern Utilities Company, serving Alva and environs.

**Electragists Elect Executive Committee.**—The following members of the Association of Electragists International have been made executive committeemen: Eastern Division — W. Creighton Peet, New York City (one year); Great Lakes Division—Earnest McCleary, Detroit (one year); Southern Division—Joseph A. Fowler, Memphis (two years); Central Division—A. Penn Denton, Kansas City (two years); Mountain Division — E. C. Headrick, Denver (one year); Pacific Division — Clyde L. Chamblin, San Francisco (two years); Western Canadian Division — J. H. Schumacher, Winnipeg (one year); Eastern Canadian Division—R. A. L. Gray, Toronto (two years). The only new members are Mr. McCleary, who succeeds Leslie G. Ross of Superior, Wis., and Mr. Schumacher, who succeeds C. C. Carter of Vancouver, B. C.

**New Plant Contemplated for San Antonio.** — Preliminary plans for a steam-electric power plant on the Guadalupe River near New Braunfels, Tex., for the purpose of supplying San Antonio with cheaper electric power have been completed, according to announcement by W. B. Tuttle, vice-president San Antonio Public Service Company. The proposed plant will be built and operated by the Comal Power Company, a subsidiary of the San Antonio company, which has made application to the State Board of Water Engineers to use the water of the river for condensing purposes. Actual construction will not start for some time, Mr. Tuttle says, but a 45-acre site has been selected.

**Wisconsin Company Buys Illinois Plant.**—Entry into the interstate electric light and power business has been indicated in the announcement made by B. F. Lyons, vice-president and general manager of the Beloit (Wis.) Water, Gas & Electric Company, of the purchase of the plant and distributing properties of the Citizens' Utilities Company of Durand, Ill., which has filled the electric light and power requirements of consumers in Davis, Rock City, Dakota and Durand with energy bought from the Rockford Electric Company. The Durand properties are about 20 miles southwest of Beloit and will be supplied with energy from the Beloit plant, to be followed by an extension of service to consumers in the towns of Shirland and Harrison, Ill.

**Consumers Power Company's New Hydro-Electric Station.**—The Consumers Power Company of Jackson, Mich., has under way a dam on the Manistee River 28 miles northwest of Cadillac on the boundary between Manistee and Wexford Counties and 12 miles upstream from the company's Junction hydro-electric plant, with which it will be connected by a 140,000-volt transmission line. The new plant is to be named after A. G. Hodenpyl, a director of the company. It will contain two 12,000-hp. vertical-shaft turbines each coupled to a 8,888-kva. Allis-Chalmers generator and will be similar to the company's Nio and Alcona plants on the Au Sable River. Work on the dam, which is an earth embankment with a concrete core, the height varying from 40 ft. to 65 ft., is proceeding rapidly. The plant is scheduled to deliver power by June 1, 1925, and to be completed next August.

**Gas Street Lamps Fighting in Last Ditch in Springfield, Ohio.**—The gas street lamps which have been operated in certain sections of Springfield, Ohio, since those sections were built up are at last threatened with extinction. Several months ago the Ohio Edison Company made a proposition to the city whereby these lamps would have been replaced with electric units. The gas company obtained petitions signed by numerous residents of the sections affected, asking the commission to retain the gas lamps. About a month ago the gas company informed the city that it would be necessary to charge $3.50 per lamp per year more than in the past because of increased costs, and the petitions previously signed were used to help support the demand. The increase was permitted, but many of those who signed the petitions are aroused and are now advocates of electric lighting. Petitions to substitute it for gas are likely to be the next step.

**Second Home-Lighting Course for Women at Harrison, N. J.**—The first home-lighting course for women held at the Edison Lamp Works of the General Electric Company, Harrison, N. J., last June met with such success that it has been decided to hold a second conference in January. The course includes lectures on elementary electricity, fundamentals of lighting, principles of home lighting (including the aspects of health, comfort, color and decoration) and publicity methods and results. It includes problems in house wiring, home lighting and the use of blueprints. There will be field trips to the showrooms of wholesale fixture houses and at least one fixture factory. In this connection it is interesting to note that at the conference of the National Committee for Prevention of Blindness in November the need for trained persons as reliable informants on home-lighting matters was particularly stressed.

**Hall of Fame for Engineers.**—The National Museum of Engineering and Industry, projected by prominent engineers and industrial leaders, which is to cost $5,000,000 and be erected on the Mall in Washington, will contain, if the plans of the founders are carried out, a "National Hall of Fame for Inventors, Engineers and Pioneers of American Industry." "Bronze and marble sculptures of outstanding American inventors, engineers and industrial leaders whose achievements have placed the United States in the forefront of industrial progress will be installed in the rotunda chamber," says the official prospectus. "The aggregated material advantages secured for civilization by the American group there represented are incalculable and far outweigh the material accomplishments of any other national group that could be assembled. The records of their epochal achievements, which are now scattered throughout the United States, including all original models that are recoverable and authentic replicas of those that are now lost or destroyed, will be assembled in the main industrial chambers of the new museum, where the evolution of American and world industries is to be graphically portrayed on what is planned to be the most comprehensive scale ever attempted by any nation." The headquarters of the museum are in the Engineering Societies Building, New York. Dr. Elihu Thomson is president and H. F. J. Porter secretary. Vice-presidents are Thomas A. Edison, Orville Wright, C. F. Brush, Leo H. Baekeland, E. G. Acheson, Frank J. Sprague and Edward Weston. Dr. Charles W. Eliot, Herbert Hoover, General G. W. Goethals, Charles M. Schwab and Melville Stone are an honorary advisory board.

# Men of the Industry

## H. V. Bozell Joins Bonbright & Company

Harold V. Bozell, for the past two and a half years editor of ELECTRICAL WORLD jointly with W. H. Onken, Jr., has resigned, effective January 1, 1925, to join Bonbright & Company, Inc., investment bankers dealing almost exclusively in bonds and preferred stocks of electric light and power companies. Mr. Bozell's work will be largely advisory, covering utility operations and technical matters, and his appointment represents an expansion of Bonbright & Company in the direction of maintaining more intimate contact with the light and power industry.

H. V. BOZELL

The training of Mr. Bozell as educator, editor and consulting engineer gives him an experience, a perspective and an acquaintanceship which equip him admirably for his new work. During his years with the McGraw-Hill Company Mr. Bozell has been co-editor of the *Electric Railway Journal*, editor of *Bus Transportation* and co-editor of the ELECTRICAL WORLD.

After his graduation from the University of Kansas, his native state, in 1908, Mr. Bozell spent nine years at the University of Oklahoma, where, as a professor, consulting engineer and secretary of the Oklahoma Utilities Association, he was very active in promoting technical, educational and public interests generally in the state. His good work there resulted in his becoming a professor at Yale University in 1917 and continuing in that position until he joined the McGraw-Hill staff. At Yale he developed graduate courses in public utility management and finance. During the war Mr. Bozell was active in supervising the training of signal personnel in colleges, was director of the Signal Officers' School at Yale and conducted special investigations for the Naval Consulting Board.

Mr. Bozell is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers, the Society for the Promotion of Engineering Education, Illuminating Engineering Society and other organizations. He has been active in society affairs. He takes with him to his new work the best wishes of his many friends, including those of his associates in the McGraw-Hill Company, who have received with sincere regret the news of his resignation from their ranks.

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**E. M. Herr**, president of the Westinghouse Electric & Manufacturing Company, with headquarters in East Pittsburgh, Pa., has moved his offices to New York City, effective January 1, 1925.

**C. Henry Dahl**, who has been affiliated with the Winnipeg Electric Company since 1919, has been appointed assistant general manager of the company, following the retirement of John Whitsell as operating manager.

**Arthur Wright**, British consulting engineer and inventor of the Wright demand indicator, left for home, via Jamaica, December 24 after spending a fortnight in America. During his stay Mr. Wright visited Boston and New York.

**George W. Allan, K. C.**, has been unanimously elected president of the Winnipeg Electric Company and the Manitoba Power Company by the directors of both organizations to succeed Sir Augustus Nanton. Sir Augustus has been president of the Manitoba Power Company since its organization and of the Winnipeg Electric since 1918.

**Ralph W. Coffin** has resigned as superintendent of construction for the Cape & Vineyard Electric Company, Falmouth, Mass., and has severed his connection with the company. He entered the company's service nine years ago as chief engineer of the Vineyard Haven plant and for a time was in charge of the Hyannis office as district manager.

**F. A. Merrick**, now vice-president and general manager of the Canadian Westinghouse Company, has been elected vice-president and general manager of the Westinghouse Electric & Manufacturing Company, effective January 1, 1925. Mr. Merrick will have general executive charge of the parent company.

**James L. Kilpatrick** has been elected vice-president of the Western Electric Company in charge of the telephone department to succeed Dr. Frank B. Jewett, who, as was announced in last week's issue of the ELECTRICAL WORLD, has been made vice-president of the American Telephone & Telegraph Company. In his new position Mr. Kilpatrick will have supervision over the manufacture, installation and telephone distributing departments of the company. He has also been elected a director of the Western Electric Company and the International Western Electric Company. Mr. Kilpatrick has been identified with the Western Electric since 1922 and with the Bell System since his nineteenth year.

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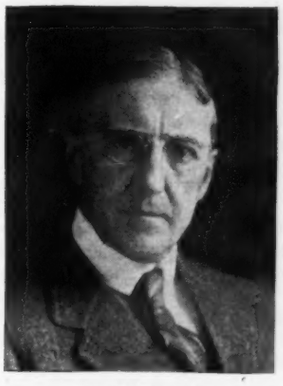
## F. C. Pratt New Director of Manufacturing in Schenectady

Francis C. Pratt, who was appointed vice-president of the General Electric Company in charge of manufacturing, as was announced in a recent number of the ELECTRICAL WORLD, has been affiliated with the organization since 1906, when he entered its employ as assistant to E. W. Rice, Jr., then vice-president in charge of engineering and manufacturing. Six years later he was appointed assistant to the president, and in 1919 he was elevated to the vice-presidency in charge of engineering.

Mr. Pratt was born in Hartford, Conn., in 1867 and was graduated with the degree of Ph.B. from the Sheffield School of Yale University in 1888. He



F. C. PRATT

entered the plant of the Pratt & Whitney Company at Hartford in 1890, his father being president of that concern. Subsequently he was advanced to the position of vice-president, but in 1906 he severed his connection with the organization to join the General Electric Company. Mr. Pratt is a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.

# Obituary

**H. L. Parker**, chairman of the board of directors of the Emerson Electric Manufacturing Company, St. Louis, died at his home in that city December 15 from the effects of a cerebral hemorrhage. Mr. Parker was born in Pepperell, Mass., in 1854 and after being graduated from the Worcester School of Technology entered the iron-manufacturing business owned by his father. Subsequently he went to Mexico, where he affiliated himself with the Mexican Central Railroad. Going to St. Louis from Mexico, he acquired the controlling interest in the Emerson Electric Manufacturing Company. A year ago Mr. Parker retired from the presidency to assume the post he held at the time of his death.

# Commission Rulings

**Defense of the Service Charge.**—The Alabama Public Service Commission in adjusting rates for the gas company serving Montgomery said concerning a service charge approved: "It appears that some customers object to the service charge because they are of the opinion they get nothing for the $2. This is a popular error. It costs the company money to be ready at all times to render service, and the service charge is based upon the fact that the manufacturing plant and distribution system must be kept in a condition to render service whether the customer wishes to use gas at the moment or not. The service charge in the gas rate may be compared in some respects to the telephone rental charge and to the standby charge of the taxicab, which are familiar forms of collecting for service rendered."

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**Difference Between Electricity for Pumping Drinking Water and for Irrigation Pumping.**—The Rogue River Water Company of Grant's Pass, Ore., a customer of the California Oregon Power Company, sought to make applicable to its use the rate applied to irrigation users in the same territory. The Oregon Public Service Commission refused so to construe the rates, saying: "The characteristics of these two loads are in no wise similar. Continuity of domestic water service is a primary essential, and this commission would not permit such a water utility to require no better standard for its pumping service than is ordinarily supplied to irrigation consumers. Power rates for irrigation purposes contemplate the use of plant capacity normally installed for use during the winter lighting peak at a time when it would otherwise be idle, and rates for such service are correspondingly reduced. In all other instances coming before this commission water pumping for domestic supply has been considered as industrial power, and it will be so considered in this case."

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**Rule Requiring Customer to Ground Neutral Wire of Alternating-Current Service Upheld.**—The Missouri Public Service Commission has sustained a general rule submitted by the Kansas City Power & Light Company and reading as follows: "The neutral or grounded wire of alternating-current service shall be permanently grounded on the customer's premises to a water pipe. This includes all two-wire, 115-volt, three-wire, 115/230-volt, and three-phase, 230-volt service. The ground shall be made to a water pipe from the entrance side of the service switch and on the street side of the water meter. The neutral or grounded wire when so grounded shall not be fused at the entrance cut-out. If no water pipe is available, the customer shall provide a suitable ground, which shall be installed in accordance with the previous of the National Electrical Code, which will be furnished upon request." In sanctioning the rule the commission said: "The purpose of the rule requiring the ground wire to be located as specified therein is to prevent an excessive voltage on the wiring of the customer, which excessive voltage is likely to break down wiring, sockets or apparatus and cause fires or personal injury to those on the customers' premises coming in contact with the electrical apparatus. The company proposes that the rule shall apply to new customers and that the grounding as required by the rule shall be done at the expense of the customer. It is a part of the customer's equipment. A witness for the company estimated that the additional cost of the work and equipment required by the rule would average from $2 to $3 per customer. . . . The company offered in evidence a rule of the National Electrical Code . . . Chester LaPierre [for the public] testified in opposition to the rule. He estimated that the cost of grounding as required would amount to from $4 to $5 for each residence and as much as $45 for apartments. He said that an ordinary ground could be made by running the wire directly from the customer's wire to the ground at an expense of about $1 and that this would suffice. The added cost in attaching to a water pipe seems to be occasioned by the necessity of often extending the ground wire the length of a customer's building to reach a water pipe. The commission holds that the rule proposed by the company is a reasonable requirement for safety in furnishing electric service."

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**Rule Requiring Consumers to Furnish a Certain Type of Fuse Box Disapproved.**—The Missouri Public Service Commission refused to allow the Kansas City Power & Light Company to require its customers to install a certain type of fuse box, saying that it found the rule arbitrary and unreasonable and in violation of the law in that it had never been submitted to the commission for approval. The commission continued: "The type of box advocated by the company has some advantages to both the consumer and the company over the old boxes. A substantial objection to the rule is that it requires a particular type of box which can be obtained only from restricted sources at a higher cost than other boxes. The defendant undertakes to prescribe the particular kind of a box which it claims is necessary to render safe and adequate service and which defendant further claims should be sealed or controlled by it. The advantages accruing from the box required by defendant appear to be in favor of defendant although the consumer does get some advantage therefrom. The price of the boxes required by defendant can more likely be reduced if the installation is made by defendant and charged to its capital account. The box advocated by the defendant is so closely identified with the installation and testing of the meter that we would probably be justified in approving a rule permitting the company to install the box and charge it to capital."

# Recent Court Decisions

**Holder of Two Permits to Construct Power Plant Cannot Apply Same Works on Both.**—In Syster vs. Hazzard suit was brought to cancel a permit for power-plant development bought at sheriff's sale on the ground that its conditions had not been complied with. The purchaser, who was the defendant in the action, had previously obtained from the State Engineer another permit for diversion of water at the same points, and on this permit he applied works already constructed under the permit he purchased. This, the Supreme Court of Idaho has held, he had a legal right to do, but in doing so he automatically abandoned the senior permit since fulfillment of two permits could not be based upon identical work. The objects to be achieved under the two permits being identical, it could not be supposed that the defendant intended to spend $100,000 to fulfill the sum of their terms when half that amount would suffice for the development contemplated. Claims of trespass were disallowed on the ground that where an owner of real property encourages one believing himself the owner to construct valuable improvements thereon, such person is estopped from subsequently alleging trespass. (229 Pac. 1110.)*

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**Deducting Entire Book Reserve for Depreciation an Error of Law.**—To deduct from the fair value of utility property the entire book reserve for depreciation in order to reach a rate base was declared error of law by the United States District Court for the Southern District of New York in New York Telephone Company vs. Prendergast. The court said: "In point of fact the property had not depreciated that much; the commission did not find any such depreciation. It did hold that plaintiff was estopped by the figures of the book reserve; it was 'bound by its own contention,' because 'these depreciation reserves represent the company's own best estimate of the extent to which their own property has aged.' This is merely untrue; the book charges represent what observation and experience suggested as likely to happen, with some margin over. The legal error is in not recognizing that the law requires deduction only for actual depreciation, just as actual as the present value, and the extent of that depreciation must be ascertained by the same kind of evidence; in the last analysis, opinion based on contemporary investigation. The rule enforced by the commission would cause some alarm if a catastrophe of nature instantly produced a deterioration of 50 per cent when the book reserve was but half that amount; yet a real estoppel must always be mutual, and it is proverbially a poor rule that does not work both ways." (300 Fed. 822.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

# Manufacturing and Markets

## National Electrical Code in Diagram

**Interesting Presentation of the History and Present Status and Operation of the Code**

THE accompanying series of diagrams has just been prepared by A. Penn Denton, chairman of the National Electrical Code committee of the Association of Electragists International, to demonstrate the organization structure supporting the National Electrical Code and to indicate the essential features of code management, revision and enforcement. The charts give the history of the electrical committee and show how it is made up and in this graphic form do much to clarify the rather hazy idea obtaining in the minds of most electrical men, not as to the influence of the code, with which they are well acquainted, but rather its status in the industry and the mechanism by which it is directed and controlled. Chart 1 indicates the growth of the electrical influence in the code until it now overshadows the government and insurance interests. This has come about as the result of the approval of the code last July by the American Engineering Standards Committee, so that it now has a legal standing and is greatly enhanced in influence and value.

### Standing Committees Revise Code

Chart 2 shows the make-up of the standing committees that revise the code and gives a clear idea of the manner in which changes in the code must be considered. These definite standing committees are in accordance with the practice of the American Engineering Standards Committee. Each of these standing committees in considering questions that are within its particular field has one or more technical sub-committees on which it may call.

The present enforcement of the code is shown in Chart 3. Its application has been through the co-operation of the central-station company, the manufacturer and others in the electrical industry who are vitally interested in upholding the code. In addition, the National Fire Protection Association, while having no legal standing, also has had a self-interest and has been able to enforce the code by the threat of an increase in insurance rates or by refusing to insure.

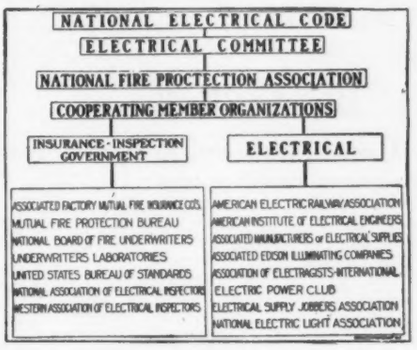



CHART 1

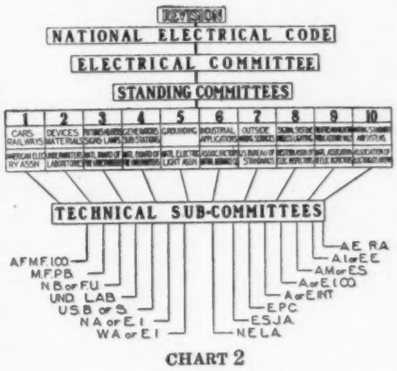



CHART 2

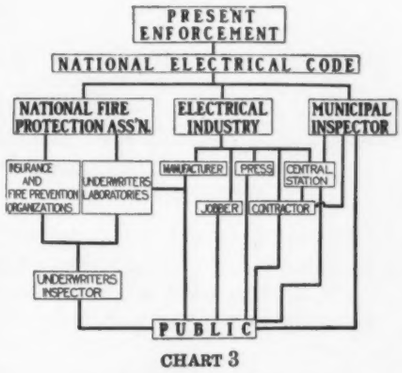



CHART 3

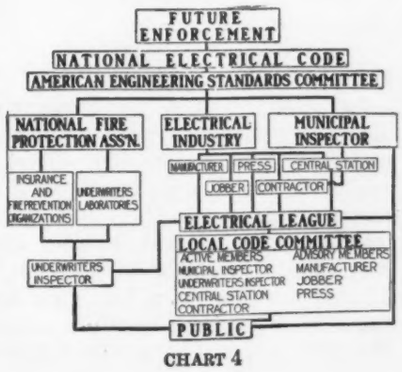



CHART 4

Chart 4 shows the better prospect for enforcement in the future which will be made possible by the new basis for administering the code. This arrangement should be especially valuable when the code has become universally adopted in all communities as a national uniform standard. Local code committees consisting, as shown, of both active and advisory members are being gradually organized, and there are now more than one hundred cities in which these committees have been set up.

### Code Now Has Legal Status

The value of the local code committee has already been well set forth by Mr. Denton in an article in the November 1 issue of the ELECTRICAL WORLD. The new set-up differs from the old in that the approval of the American Engineering Standards Committee now gives the code a legal status. In addition, to assist enforcement and to provide a clearing house for all necessary revisions and changes to the code, local code committees under the supervision of the electrical leagues are also being recommended and established.

## Hoover Advises a Radio Sales Tax

SPEAKING on the future of radio broadcasting, Secretary Hoover has expressed a belief that a tax on the sales of radio equipment, say 2 per cent, is the only reasonable suggestion he has heard that would provide funds to pay for daily programs of the best skill and talent.

One company reported sales of more than $22,000,000 in 1923, and the figure for 1924 will be a good deal higher. The improvement of programs is considered by Mr. Hoover as being more important now than further regulation until it becomes possible to say what form of regulation is needed.

"This country would never stand for licensing or taxing radio listeners," Mr. Hoover said. "That idea only works when one company has a monopoly and all the revenue so derived goes into one pool, but we

don't like monopoly. And, then, how are you going to keep the unlicensed folks from listening in? Are you going to have a police force snooping around for illicit aerials and searching people's homes? People go into theaters and pay admission and that solves the problem right there for the stage or concert hall, but it is obvious that there is no such way of getting the radio audience to pay for what it gets. So you've got to approach that some other way—leaving out the license-tax scheme.

"Radio is becoming more important in the life of the country every day. It is already one of the necessary adjuncts. Right now I think the most important thing is improvement of what is put on the air. That is the most vital thing of all. It isn't so much a question of growth, because that takes care of itself as long as the material put out is really worth while."

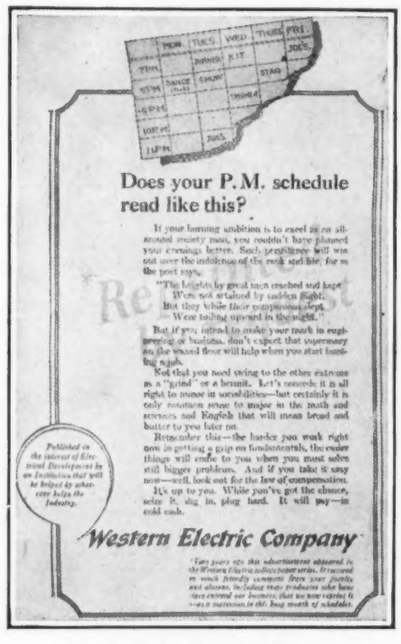
# Recruiting from the Colleges

## A System of Advertising to College Men, Visiting and Interviewing—Post-Graduate Courses After Employment

BY JOHN MILLS
Chairman College Relations Committee,
Western Electric Company

SEVERAL hundreds of college and technical school graduates every year find permanent employment in the varied activities of the Western Electric Company. Their selection on graduation, their placement and introductory training in the industry and the insurance of adequate opportunities for their continued development are matters in which the executives of the company take a keen and detailed interest. For more than a quarter of a century the company has provided in its organization for this vital matter of enlisting and developing the trained brains and future executive personalities which our American colleges produce. In fact, many of its upper executives are college graduates, who worked up from the ranks. In recognition of the importance of fitting into the company technical school and college graduates, as early as 1898 there were instituted and organized training programs for college graduates. Today each of the major departments of the company—manufacturing, engineering, installation, sales, and even the smaller departments like purchasing and patents—offers training programs for introducing college graduates to the work of the company as a whole and to the specific problems and methods of each department.

The training period differs in length and in type with the particular needs of the department, but in general involves training by transfer on the job, inspection trips, lectures, required reading with written reports, and in some cases formal courses of study. These courses are selected by the employee, subject to advice and approval by his immediate supervisor. Experience has shown a very small labor turnover among the employees who make use of these facilities for further study of the basic principles or their technical applications.




REPRESENTATIVE COLLEGE PAPER ADVERTISEMENT

### SCHOOLING OF EMPLOYEES

In addition there are arrangements whereby each year a number of selected employees are excused from their regular duties at certain hours of the day to obtain graduate courses in mathematics, physics and theoretical chemistry at Columbia. During the five years that this arrangement has been in effect a considerable number of college-trained employees have completed the work for a master's degree at Columbia, and a larger number have profited by taking special graduate courses not leading to this degree.

All departments of the company have developed special training methods to fit their departmental needs. In the engineering department there are so-called "out-of-hour" courses, given two days each week from 8 to 9 a.m. and from 5 to 6 p.m., with two terms of eight weeks during the winter months. In the installation department, where the employees are scattered all over the United States and are changing locations as they move from job to job, much of the instruction is done by correspondence methods with texts specially prepared by experts in the department. At the vast plant at Hawthorne, Ill., in addition to the many different training courses which have been developed for the introduction of employees, an enormous evening school is operated with a staff of thirty instructors and a student body of about two thousand.

### ADVERTISING TO COLLEGES

Owing to the wide range of work and the large number of men required by its rapid and continued growth, the company is one of the best industrial purchasers of the trained product of our American colleges and technical schools. As a large purchaser it is enabled to speak with some authority to student bodies as to those characteristics and abilities which make for success in later life. This it attempts to do in the advertising which it publishes in college magazines "in the interest of electrical development by an institution that is helped by whatever helps the industry."

For some years it has run in a large number of representative college papers a distinctive series of advertisements. These are directed toward assisting the student and encouraging him to make the most of the educational opportunities which he is at present enjoying. Its emphasis is always placed on broad training and the development of those human characteristics which lead to the right combination of initiative and co-operation to meet the complex requirements of modern business and especially of the electrical industry. These advertisements have had a distinct effect and have been favorably commented upon by the alumni and faculty in many col-

leges. Just why this should be so is easily seen from the sample advertisement reproduced here. This advertisement was so successful in its appeal that it was reprinted by request and might justly warrant reprinting for each freshman as he enters college.

SEEKING THE MEN

Recruiting from the colleges is undertaken in the early spring of each year and is carried out by a Bell System delegation under the chairmanship of a representative of the operating telephone company in whose territory the educational institution is. These delegations contain representatives familiar with the various types of work and opportunities in the Bell System as a whole and in the various departments of the Western Electric Company. A delegation, usually consisting of four members, visits a college or technical school and interviews the senior or graduate students who wish to be informed of the opportunities in industrial work or to be considered for employment by the company. The delegation then decides as to the qualifications of each of the individuals it interviews. It then assigns to the several companies of the Bell System, including the Western Electric, for further and definite negotiations as to employment those students for whom there appear to be suitable positions.

In its search for properly talented graduates from the colleges the Western Electric is interested in obtaining men who can be the future executives in its highly technical industry with its rapidly growing commercial importance. It looks for men of sound character and of attractive personality, men who can learn from other men, who can cooperate and have a promise of leadership. It looks for men who are capable of growth to cope with the growing complexity and magnitude of its problems. It needs men who have curiosity and imagination and who have the ability to study along whatever lines they may be interested in, whether those of technical processes, of commercial relationships or of human relationships. It needs men with the habit of study—that is, the habit of growth and of adaptation—in order to meet the advances of science and industry. For no one can foresee the future extent of this great business, but any one may feel certain that it will not stand still.

# Business Conditions

SOME quietness prevails in the industry, but despite this many small equipment sales were made this week and in the aggregate a good volume of business was transacted. Several manufacturers report that there is every indication that December sales will be better than last month's, and with several inquiries in hand for apparatus, orders for which are expected to be placed soon, the men of the industry are confident that the sales of the next two or three months at least will be very healthy.

The increasing price of copper has advanced wire prices again. Wire manufacturers report steadily increasing sales and believe this to be owing more to a generally improved condition than to any rush to cover on an increased price. The Westinghouse company recently announced that its merchandise sales have actually increased over 25 per cent.

In New England there is a growing volume of business and inquiries for apparatus are increasingly active. Central-station companies are steadily purchasing small equipment in the New York district, and sales of rubber-covered and weatherproof wire have been growing. In the Southeast central stations are actively expanding, and although sales are quieter, the December volume of business is good. Equipment buying is good in the Middle West. Central-station construction has been temporarily retarded in this district by the cold weather, but further extensions are being outlined. On the Pacific Coast several inquiries for material have been received, but sales of standard lines have tapered off to an annual inventory basis.

## General Electric Again Reduces Lamp Prices

THE General Electric Company has made an announcement to the trade and the public of another reduction, effective January 1, 1925, on the prices of its larger sizes of incandescent lamps. The announcement affects and is of particular interest to the users of lamps of 100 watts to 1,000 watts. It amounts to approximately 10 per cent on these types. Factories and all industrial shops, stores, office buildings, places of business and amusement will be largely benefited by the decreased costs.

As the trend of modern commercial lighting has been toward this larger and more efficient type of lamp, lighting bills for business will be lowered everywhere.

This cut in the cost of lamps, the sixth made by the General Electric Company in the last two years, has again been made possible by improved machinery and processes which have resulted in greater manufacturing economies.

The electric lamp of today, of better quality and longer service, is one of the few articles essential to human progress which is actually selling below pre-war prices. The new price lists for "Mazda C" lamps are as follows:

| Watts | Price Clear | Price Bowl Enamel | Price Daylight |
|---|---|---|---|
| 100 | 0.50 | $0.55 | $0.50 |
| 150 | 0.65 | 0.70 | 1.05 |
| 200 | 0.80 | 0.85 | 1.30 |
| 300 | 1.25 | 1.35 | 1.85 |
| 500 | 2.00 | 2.15 | 2.85 |
| 750 | 3.50 | 3.70 | .... |
| 1,000 | 3.75 | 3.95 | .... |

## Delinquent Electrical Accounts for November Are Low

REDUCTIONS in the number of delinquent electrical accounts for November compared with either November, 1923, or October, 1924, are very noticeable after studying the reports sent out by the National Electrical Credit Association. In only one territory—New England—did the number of accounts show an increase over October, 1924. The complete report follows:

DELINQUENT ACCOUNTS IN NOVEMBER

| Branch and Month | Number of Accounts Reported | Total Amount | Average Amount |
|---|---|---|---|
| Central Division: | | | |
| October, 1923 | 981 | $117,653.05 | $109.74 |
| October, 1924 | 882 | 95,059.06 | 107.78 |
| November, 1923 | 912 | 146,308.04 | 160.43 |
| November, 1924 | 690 | 86,002.90 | 124.64 |
| New York: | | | |
| October, 1923 | 442 | 77,479.00 | 175.00 |
| October, 1924 | 300 | 34,083.00 | 113.00 |
| November, 1923 | 344 | 50,725.00 | 145.00 |
| November, 1924 | 221 | 26,657.00 | 102.00 |
| Philadelphia: | | | |
| October, 1923 | 326 | 32,547.98 | 99.84 |
| October, 1924 | 217 | 23,777.23 | 109.57 |
| November, 1923 | 222 | 29,708.60 | 133.82 |
| November, 1924 | 176 | 20,555.80 | 116.79 |
| New England: | | | |
| October, 1923 | 51 | 3,808.88 | 74.68 |
| October, 1924 | 14 | 8,788.38 | 135.20 |
| November, 1923 | 51 | 6,018.34 | 118.01 |
| November, 1924 | 56 | 3,867.63 | 69.06 |
| Pacific Coast: | | | |
| October, 1923 | 23 | 5,804.78 | 252.38 |
| October, 1924 | 45 | 5,578.65 | 123.97 |
| November, 1923 | 18 | 4,252.62 | 236.25 |
| November, 1924 | 14 | 2,630.62 | 187.90 |

## British Electrical Manufacturing Industry Active

LARGE orders have recently been booked for electric cables, and there is an increasing demand for small motors from British manufacturers. The demand for radio equipment is good and is increasing, says a cable to the Department of Commerce from acting Commercial Attaché H. D. Butler at London.

## Prices of Copper, Lead and Zinc Again Increase

GOOD domestic consumption of the metals, coupled with heavy export buying, has created higher prices for copper, lead and zinc. Several large copper producers advanced their prices to 14¾ cents for first-quarter delivery, but some metal was still available at

14⅜ cents. The directors of the Anaconda Copper Mining Company have resumed dividend payments on the capital stock and in doing so announced that the present condition and prospects are the best they have been since the ending of the war. The consumption of the metal is now said to exceed the war's peak. Export demand has been very good.

The American Smelting & Refining Company again advanced its official contract price for lead to 9½ cents. This

NEW YORK METAL MARKET PRICES

| | Dec. 17, 1924 Cents per Pound | Dec. 24, 1924 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 14⅛ | 14⅛ |
| Lead, Am. S. & R. price | 9½ | 9½ |
| Antimony | 14⅛ | 15⅛ |
| Nickel, ingot | 29½ | 29½ |
| Zinc, spot | 7.80 | 8. |
| Tin, Straits | 55¼ | 57⅛ |
| Aluminum, 98 to 99 per cent | 28 | 28 |

makes the sixth rise this month. The demand has been very active and orders for future delivery are increasing. Zinc also increased in price as the result of increased domestic consumption and foreign buying. Galvanizers have entered the market for fair quantities and the brass trade has made some purchases. Tin is firm at 57⅛ cents, but speculators are said to be purchasing in anticipation of a further advance.

## Growing Volume of Business in New England District

INQUIRIES for apparatus in the New England district are increasingly active, and all signs point to continued expansion in the new year. Retail trade is at its peak and an appreciable business of record proportions is being transacted. Late orders include a million-volt testing outfit for the American Steel & Wire Company, Worcester, Mass.; seventy 1,000-cp. ornamental incandescent lamps for Dover, N. H.; a 70-kw. and three 20-kw. electric hardening furnaces for Beverly, Mass.; another hardening furnace for Springfield, Mass., and a great number of small motor sales to diversified industries. Among the motor sales were 160 motors, aggregating 80 hp., for a Rhode Island machine-tool plant; twenty-four motors totaling 36 hp. for a Worcester factory, and a 150-hp. motor for a southern New England industry. Street-lighting inquiries are increasing and important betterments are planned for Fitchburg and Beverly, Mass., and Newport, R. I.

A Boston jobber sold a carload of rigid conduit last week for the Montaup station near Fall River. Another sold $1,500 worth of pole-line hardware to a Massachusetts central-station company. Prospects are excellent for a large volume of building this winter. Twenty-five thousand applicants for telephone service are on the books of the New England company. One central-station syndicate sold over $16,000 in appliances last week, including 200 portable bridge lamps and 134 washing machines and electrical Christmas goods are moving in large volume. Several important prime-mover deals are in the wind, but will probably not be closed until the new year. Wire buyers are rushing into the market as the price of copper advances.

## Good Equipment Buying in the Middle West

GRATIFYING evidence of increasing improvement in Middle Western business is seen in the reports. Central-station construction, while temporarily retarded by the present cold weather, is going rapidly on and further extensions are being outlined. In the Cleveland district an eleven-million-dollar generating plant is being constructed, while additional millions are being spent in the Detroit district at Trenton. Among the interesting orders received was one for indoor feeder-voltage regulators totaling about $100,000 and another for three 3,000-kw. converter units. High-tension equipment has been in satisfactory demand, manufacturers reporting the receipt of several sizable orders.

Jobbers apparently are having a good season; however, purchases have been curtailed somewhat owing to the approach of the annual inventory period. Sales of goods of a gift nature have received impetus from Christmas shopping. The sale of staple merchandise continues good in most lines. Fill-in requisitions to distributors are numerous, and sales for this week have run substantially ahead of the same period last year. Prices are generally firm, with the exception of copper and lead products. Cross-arms, which advanced 5 per cent a while back, are still in good demand. Manufacturers report that producers of fir lumber are able to obtain better prices for their products than in the manufacture of cross-arms. This difference in revenue obtainable, despite the recent advance, is not as yet equalized. The erratic product flexible armored cable has again dropped $1 per 1,000 ft., while indications would seem to point toward further advances in copper wire.

## Active Buying by Central Stations in the New York District

BUSINESS in the New York district is in good volume, although the holidays have slightly affected sales. Central-station companies have been purchasing small equipment actively and have largely helped to maintain the flow of trade. More and more big projects are being actively discussed with every indication of orders being placed in the very near future. While there has been some improvement in the sale of motors, the present market is slow, but general conditions are such that better sales are anticipated by manufacturers. Four 3,300-kw., 33,000-volt transformers were sold this week for use in Virginia at a cost of approximately $60,000. Four 667-kw. transformers were also purchased by another utility at a cost of about $10,000. More business of this class is expected to develop soon.

Since the upward movement in copper started wire sales have been very much improved. The new construction of plants and the purchase of much weatherproof wire by central stations have produced better business. More than one manufacturer believes this to be due more to a greater confidence in future conditions than to the price changes. Some good inquiries are being received for cross-arms, but no notable sales were made. Very good business is reported by jobbers, with the usual rush to replace stock sold to the holiday trade, which is consuming a record amount of appliances.

## Central Stations Active in the Southeast

CENTRAL - STATION expansion continues in the Southeast. Quotations are now being requested on several large jobs that will require poles and all types of pole-line equipment. Generally speaking, sales are quiet in the jobbing lines, though the December volume of business is in excess of the same month last year, this being chiefly due to the very good demand for radio equipment and sales of supply lines.

The "Give something electrical" idea seems to have taken hold, for jobbers report that heating-appliance and hollow-ware sales are excellent. This is to some extent the reflection of the merchandising activities of several large central-station companies. There is a sharp falling off in the sales of electric ranges, but this inactivity is considered only temporary. In the construction material line a falling off in the receipt of large orders is to be noted, though orders from small contractors for conduit and both rubber-covered and weatherproof wire are very good.

With only three days left for Christmas shopping Atlanta retail electrical dealers report business as under expectations, but portables, socket appliances and radio are active.

## Inquiries Received on the Pacific Coast—Standard Lines Slow

RECENT orders and inquiries on the Pacific Coast concern $25,000 worth of pole-line equipment for an Arizona irrigation project, including $10,000 worth of poles; several municipal bids for supplies for the forthcoming fiscal year; a carload of pole-line hardware for a northern California line and five carloads of 3½-in. and 4-in. fiber conduit for the Pacific Gas & Electric Company. Weatherproof wire has advanced in price. Several power companies, with their future apparently safeguarded by the overwhelming defeat of the vicious power and water act, are preparing for vigorous bond-selling campaigns.

Brisk holiday buying is reported by jobbers and dealers, and the net result will be little below last year. In the Northwest section present sales are reported from 10 to 15 per cent above last year. Other orders are largely for seasonable replenishments. Purchases of standard lines have tapered off to an annual inventory basis. A considerable amount of electrification of Puget Sound sawmills, principally in Bellingham, is promised after the first of the year. Already one company is placing orders for an installation costing about $85,000.

# Activities of the Trade

## Westinghouse Third-Quarter Orders to Show Increase

Orders of the Westinghouse Electric & Manufacturing Company for the quarter ending December 31 are estimated to be between $35,000,000 and $36,000,000. This compares with orders of $34,705,000 for the previous quarter and $36,435,000 for the quarter ended December 31, 1923.

This will bring orders for the first nine months of the company's fiscal year to between $110,000,000 and $111,000,000, a decrease of about 12 per cent, compared with $126,025,000 for the same period last year.

## Electric Truck Manufacturers Undertake Co-operative Program

At a meeting held at the general offices of the Society for Electrical Development on December 5 the manufacturers of electric industrial trucks undertook, with the manufacturers of storage batteries and the society, a co-operative business-building program. These companies, already members of the society, have appropriated a special fund for the purpose of promoting the idea of electric industrial trucks for material handling.

Among the companies participating in this program are the Automatic Transportation Company, the Baker R & L Company, the Cowan Truck Company, the Crescent Truck Company, the Eleveyor Electric Industrial Truck Company, the Elwell-Parker Electric Company, the Lakewood Engineering Company, the Mercury Manufacturing Company, the Yale & Towne Manufacturing Company, the Edison Storage Battery Company and the Electric Storage Battery Company.

## Jeffrey-Dewitt Insulator Receives Australian Order

The Department of Public Works of New South Wales, Australia, has been awarding contracts for material to be used on the 66,000-volt transmission line of the Barren Jack hydro-electric development. The hundred miles of line were to have been carried on large pin-type insulators as originally planned, but after six months' study of modern trends of practice and of insulator performance the engineers for this Australian government decided upon suspension insulators made in the United States. All suspension and strain insulators, with necessary hardware, as well as all post-type insulators for outdoor substation construction, were awarded to the Jeffrey-Dewitt Insulator Company, Kenova, W. Va.

This company reports an unprecedented number of inquiries for large undertakings in both the domestic and the foreign field. Manufacturing efficiency for turning out uniform insulators is at a high standard, and plans have been made for a year of shipments which will tax the plant capacity.

## Freeman Electric Consolidates with Trenton Porcelain

The Circle F Manufacturing Company, Trenton, N. J., recently chartered with a capital of $1,250,000, will take over and consolidate the E. H. Freeman Electric Company, East State Street, and the Trenton Porcelain Company, Mead and Prince Streets, and will manufacture wiring devices, electrical specialties and electric porcelain products. The new company has acquired the former plant of the Trenton Watch Company on Monmouth Street and will remodel and equip it for new works, where operations ultimately will be concentrated. For the present existing plants of the two companies at Trenton, as well as a plant at New Brunswick, N. J., will be continued in service. George E. Maguire, heretofore head of the Trenton Porcelain Company, will be president of the consolidated organization; Edgar H. Freeman, previously president of the E. H. Freeman Electric Company, will be vice-president; Lloyd H. Rockhill, treasurer, and Casper J. Faber, secretary.

## Norma-Hoffmann Bearings Occupies New Factory

The factory and general offices of the Norma-Hoffmann Bearings Corporation have been moved from Long Island City, N. Y., to Stamford, Conn., where a modern plant has just been completed on a tract of 17 acres adjoining the main line of the New York, New Haven & Hartford Railroad. One feature of this new factory—which is given over entirely to the manufacture of "Norma Precision" ball bearings and "Hoffmann Precision" roller bearings—is the use of ball and roller bearings in motors, shafting and other power equipment, to an extent probably not elsewhere found.

## Cramp Gets Order for Two 21,500-Hp. Vertical Turbines

The Phoenix Utility Company has awarded to the William Cramp & Sons Ship & Engine Building Company, 1600 Walnut Street, Philadelphia, a contract for two 21,500-hp. vertical I. P. Morris turbines, complete with governors and auxiliaries, for installation in the Cutler plant of the Utah Power & Light Corporation. These units will be somewhat similar to those now being built by the Cramp company for the Merced Irrigation District of California, where two 24,500-hp. turbines will be installed. The Cramp plant is also completing a contract for three 13,000-hp. vertical Morris turbines, together with governors, intake pipes and penstock valves, which will constitute a part of the extensive superpower development of Japan.

## Sanford Riley Stoker Company Changes Name

Constant enlargement of the activities of the Sanford Riley Stoker Company and its subsidiaries has made it advisable to change its name to the Riley Stoker Corporation. This becomes effective January 1, 1925. The company announces that this change is wholly a matter of convenience in transacting its rapidly growing business, there being no change whatever in management or policy.

The Riley Stoker Corporation is a consolidation of and successor to the following companies: Sanford Riley Stoker Company, makers of "Riley Underfeed" stokers; Murphy Iron Works, Detroit, makers of "Murphy" furnaces since 1878; Underfeed Stoker Company of America, makers of "Jones" stokers since 1890; United Machine & Manufacturing Company, Canton, Ohio, makers of "Harrington" stokers.

## F. W. Wakefield Lets Contract for New Building to Austin Company

The F. W. Wakefield Brass Company, Vermilion, Ohio, has let a contract to the Austin Company of Cleveland for the rebuilding of a factory unit recent destroyed by fire. The new building will be 60 ft. x 160 ft., one-story, standard construction. It will contain over 3,000 sq.ft. of glass. According to plan, the building will be complete and ready for occupancy within twenty-five working days from December 18, but the contractor declares that this schedule will be bettered.

In the meantime the assembling and manufacturing operations on "Red Spot" lighting specialties are being carried forward in rented space by the Wakefield company without interruption to its service.

## Wright Company Adopts Reconditioning Guarantee

The M. S. Wright Company, Worcester, Mass., has established a reconditioning guarantee on all vacuum cleaners shipped from the factory. As a special and unusual service the company agrees, without limit of time and as often as the purchaser desires, to recondition the cleaner thoroughly upon payment of a charge not to exceed $10 each time this service is rendered at the factory. When so reconditioned the cleaner will be returned to the purchaser the practical equivalent in both appearance and mechanical condition of a new "Sweeper-Vac" of the same model.

The purchaser pays all the transportation charges both ways. This practice is expected to do away with a large proportion of the so-called "trading-in" custom in connection with sales of this product. The guarantee is retroactive to Nov. 15, 1924.

### Matthews Engineering Purchased and Will Be Continued

The Matthews Engineering Company, Sandusky, Ohio, manufacturer of Matthews automatic electric light and power plants, has been purchased by M. Prussian of the Michigan Surplus Materials Company and A. H. Nimmo of the Nimmo Electric Company, both of Detroit. The business will be continued under the same name. The plant and equipment, which was recently offered for sale by M. C. Cosgray receiver, has been running as a going concern.

**The Electric Service Supplies Company**, Seventeenth and Columbia Streets, Philadelphia, announces that the name of the old "Aetna" commutator smoothing stone is now changed to "Cass."

**The Elevator Supplies Company, Inc.**, Willow Avenue, Hoboken, N. J. announces that it will open an office at 119 Spring Street, Atlanta, Ga., on January 1. W. A. Crowe, for many years in charge of the Philadelphia office will take charge of the Atlanta territory and will be succeeded in Philadelphia by Harry Weldon.

**The Belden Manufacturing Company**, Twenty-third Street and Western Avenue, Chicago, has issued new price lists of December 10 for the cord and specialties and radio departments.

**The Western Electric Company** has filed plans for the erection of a group of additional buildings at its new plant now in course of erection at Kearny, N. J. The structures will consist of a main six-story unit, with smaller buildings to total about 750,000 sq.ft. of floor area, and are estimated to cost close to $2,500,000, with machinery.

**The Liberty Appliance Corporation, Hoboken, N. J.**, manufacturer of electrical equipment, has leased the three-story building, 50 ft. x 100 ft., at 306 Jefferson Street, for a local plant, and will install equipment at an early date, using two floors for production.

**The General Electric Company** announces that work is progressing rapidly on its new building at Detroit. The building will cost approximately $500,000 and will be used as a warehouse and service shop for the purpose of supplying Detroit and vicinity. Occupation is expected to begin about March of next year. The completion of plans for the erection of this building was announced in the May 10 issue of ELECTRICAL WORLD.

**The Allmur Manufacturing Company**, Marion, Ind., manufacturer of electric appliances, now established at Western and Euclid Avenues, will move soon after the first of the year to the plant formerly occupied by the Marion Baking Company, Eleventh and Adams Streets, where increased facilities will be provided.

**The Metropolita. Engineering Company.** Granite City, Ill., has been organized to handle the electrical and mechanical features of high-speed newspaper machinery, specializing on design, installations, superintendence and automatic switchboard control equipment. The officers are Paul S. Pender, chief electrical engineer, formerly with the printing equipment department, Cutler-Hammer Manufacturing Company, Milwaukee, and Daniel B. Donnelly, for 28 years directing mechanical head of several metropolitan newspapers in the East and central West.

**Pass & Seymour, Inc.**, Syracuse, N. Y., manufacturer of electric wiring devices, announces that it has furnished the streamers, requiring 1,500 electric lamps, for the illumination of the living Christmas tree which has been planted on the White House grounds. The idea of planting a living tree was sponsored by the Society for Electrical Development.

**The Champion Electric Company**, 3711 Forest Park Boulevard, St. Louis, has been organized and incorporated by J. B. Dobyne, president and treasurer, and George A. Dobyne, vice-president and secretary, to manufacture motors in the single-phase, two-phase, three-phase, direct-current and split-phase types. The Champion Electric Company is an entirely separate organization from the Champion Shoe Machinery Company. This corrects an item appearing in our November 29 issue on page 1183.

## New Equipment Available

### Electrode Holder

A new type of welding electrode holder that permits of a quick change from a burned stub to a new electrode has been placed on the market by the General Electric Company. The operator needs only to strike the stub end of the old electrode, causing it to drop out, when the new wire can be inserted. The new holder consists of a punched fiber tube with a tinned brass plug inserted in the end. A steel spring rod holds the electrode in place against one of a number of different-sized notches provided for the purpose. The welding cable running to the source of power is soldered to the other end of the holder by removing the fiber tube and fiber guard, this being accomplished by loosening a single screw. The construction of this holder is such that the contact of the electrode is not weakened by heat.

### Disk and Ball Bearings

A line of disk and ball bearings known as the NKA, which are said to have a high load-carrying capacity, has been placed on the market by the Wollmar Engineering Corporation, 224 East Forty-second Street, New York, as the American representative of Nordiska Kullager Aktiebolaget, Gothenburg, Sweden. The disk bearing is made up of two race rings, between which rollers having convex race surfaces and flat side surfaces are placed. The rollers are self-guiding.

The ball bearing, which is available in both radial and thrust types, has a cage of spring steel wire that is looped between each pair of balls, embracing a segment of each ball. This construction is claimed to minimize friction, takes up little space, and permits lubricant to get in between the balls. The cage is flexible and resistant to wear, and the balls may be inspected without taking the bearings apart.

### Reduction Gears

Two new types of reduction gears, known as types H and K, have been recently developed by the Poole Engineering & Machine Company, Baltimore. The type H reduction gear or speed transformer consists of a double helical or herringbone gear made of special-analysis open-hearth steel forging and a herringbone pinion cut integral with high-speed shaft made of chrome canadium steel and heat-treated. Gears and pinions are totally inclosed and bearings are removable.

For low-speed drives lubrication is obtained by a splash-and-gravity system. For turbine and other high-speed drives an oil pump and cooler is provided. The type K reduction gear consists of a double helical or herringbone forged-steel pinion integral with the shaft and a cast-steel double helical spur gear. Both gear and pinion have cut stub teeth. Bearings are of the ring-oiling type and the gear and pinion are lubricated by the splash system. The high-speed shaft in the type K gear is in the top of the casing and the driven shaft is directly under the pinion shaft and just below or near the floor line, which makes it desirable where the line shaft is close to the floor.

**Reflectors.**—A complete new line of reflectors for show windows, display cases and interior lighting, known as "Sterling Stipple" reflectors, have just been placed on the market by the Reflector & Illuminating Company, 565 West Washington Boulevard, Chicago. The reflector is constructed of clear crystal glass and silvered with three applications of grain silver. This highly polished reflecting surface is protected against mechanical abrasions by a deposit of copper, which is covered with a layer of baked Indian-brown enamel. A special process of crystallized finish is used over the enamel. A patented reflector holder, which is adjustable and fits all standard brass or porcelain sockets, is also provided.

**Safety Switches.**—A new line of quick-make, quick-break safety inclosed switches without the full safety features, known as the WK-60, has been placed on the market by the Westinghouse Electric & Manufacturing Company. The quick-operating mechanism has been condensed and is placed inside the handle. Other features include absorbing the impact of the quick-operating mechanism and checking the burning of contact areas. Mechanical parts subject to wear have been hardened, and the parts are heavier than standard to withstand the service.

## New Trade Literature

MOTOR STARTERS AND CONTROLLERS.—Bulletin No. 64 issued by the Ward Leonard Electric Company, Mount Vernon, N. Y., contains a complete list of its manually operated alternating-current motor starters and controllers so arranged that the user can readily find the entry of the apparatus required.

DIRECT-CURRENT WATT-HOUR METERS.—The Duncan Electric Manufacturing Company, Lafayette, Ind., has issued bulletin No. 130, which is a revision of No. 115, containing instructions for installing, reading, cleaning, repairing and testing the "Duncan" direct-current watt-hour meters. Tables are also given showing register ratios and test constants for the above meters.

SWITCHBOARD CONSTRUCTION.—"Switchboards in Architecture" is the title of a twenty-page pamphlet, known as Y-1929, issued by the General Electric Company, Schenectady, N. Y., containing reprints of advertisements which are bound together with other data to set forth many essentials of value when planning or writing specifications for switchboards to be installed in buildings.

PORCELAIN INSULATORS.—Catalog No. 101 issued by the Illinois Electric Porcelain Company, Macomb, Ill., describes the various types of electric porcelain insulators manufactured by the company. A series of photographs illustrating the different steps in the process of manufacturing the various types of "Illinois" insulators are also included, as well as graphs and charts showing the electric strength of air and porcelain, etc.

SURFACE-AIR COOLERS.—Bulletin No. 45 issued by the General Electric Company, Schenectady, N. Y., describes the general construction, principles of operation, etc., of the generator surface-air cooler manufactured by the company. A partial list of installations of this cooler is also given.

REPAIR PARTS FOR METERS.—The Sangamo Electric Company, Springfield, Ill., has issued bulletin parts list No. 9, which contains a price list of repair parts for the "Sangamo" type H watt-hour meters, single-phase and polyphase, service and switchboard types.

DIESEL ENGINES.—The Fulton Iron Works Company has issued bulletin No. 807, entitled "The Diesel Engine in Medium-Power Central Stations," which shows the advantages of the use of Diesel engines in small and medium-sized generating plants. Two tables are given showing the savings due to Diesel-plant operation.

POWER TRANSMISSION MACHINERY.—Catalog No. 31 issued by the W. A. Jones Foundry & Machine Company, 4,401 West Roosevelt Road, Chicago, covers the "Jones" transmission machinery, including shaft hangers, pillow blocks, couplings, belt tighteners, etc. All items are listed, dimensions given, etc.

BALL BEARINGS.—A folder entitled "Pioneering Ball Bearings in America" has recently been issued by the Standard Steel & Bearings, Inc., Plainville, Conn. The folder covers the history of ball bearings with special reference to the part played in it by the "SRB" organization.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in the Azores (No. 12,813) of radio sets and parts.

Purchase is desired in Brazil (No. 12,812) of alternating-current generator.

Purchase is desired in Brazil (No. 12,776) of a 100-hp. horizontal engine with boilers.

Purchase is desired in Chile (No. 12,811) of materials for encasing telephone cables underground.

Purchase and agency is desired in England (No. 12,766) for electrical appliances.

Purchase is desired in Germany (No. 12,810) of electrical supplies, including cooking apparatus, vacuum cleaners and lighting plants.

Purchase and agency is desired in South Africa (No. 12,816) for radio sets and parts, especially tubes.

Purchase and agency is desired in Spain (No. 12,807) for radio sets, parts and accessories.

An agency is desired in Czechoslovakia (No. 12,817) for electric motors.

An agency is desired in England (No. 12,786) for electric irons, labor-saving devices and vacuum cleaners.

An agency is desired in Greece (No. 12,737) for arc lamp carbons.

An agency is desired in India (No. 12,777) for electric headlights for locomotives.

An agency is desired in Italy (No. 12,815) for radio sets and parts.

An agency is desired in New Zealand (No. 12,806) for radio sets, electrical goods, etc.

An agency is desired in Sweden (No. 12,773) for films for Roentgen X-ray work.

## New Incorporations

THE PEOPLE'S LIGHT & POWER COMPANY, Hominy, Okla., has been incorporated by P. A. Wilkins, L. A. Camp and P. J. Minck. The company is capitalized at $25,000.

THE MICHIGAN ELECTRIC POWER COMPANY, Bad Axe., Mich., has been incorporated with a capital of $1,000,000 and 20,000 shares stock, no par value, by Norman J. Frost, John G. Clarke and John N. Rankin, all of Bad Axe.

THE ST. PAUL COMMUNITY LIGHT COMPANY, R.F.D. 3, Salisbury, N. C., has been incorporated by J. L. Rogers, A. A. Misenheimer and R. S. Safrit.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

PORTSMOUTH, N. H.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for an electrically driven capstan for the local navy yard.

BOSTON, MASS.—Bids will be received by the Public Works Department, City Hall, until Jan. 6, 1925, for electrical equipment, one and two pumping units for the Calf Pasture pumping station, to cost about $150,000. J. A. Rourke is commissioner.

SOUTH MANCHESTER, CONN.—Contract has been awarded through the office of Lockwood, Greene & Company, engineers, Boston, for the construction of a service building for the Manchester Memorial Hospital. This extension includes a temporary boiler room. Later on a power plant will be built.

## Middle Atlantic States

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company has applied for permission to extend its transmission lines into the towns of Vienna and Florence and for approval of franchises granted by the Town Boards.

ELMIRA, N. Y.—The Elmira Water, Light & Railroad Company has arranged for an increase of $1,000,000, in capital stock, part of the proceeds to be used for extensions in transmission lines.

MANLIUS, N. Y.—The Public Service Commission has granted the Syracuse (N. Y.) Lighting Company permission to extend its transmission lines in the town of Manlius and has given its approval of franchise granted the company by the Town Board.

NEW YORK, N. Y.—Bids will be received by John E. Bowe, Commissioner of Purchase of the City of New York, Room 526, Municipal Building, until Dec. 31, for furnishing incandescent lamps to the Department of Water Suply, Gas and Electricity.

NEW YORK, N. Y.—The New York Edison Company has filed plans for the erection of a distributing station at 308-12 West Thirty-sixth Street, to cost about $400,000. William Whitehill, 709 Sixth Avenue, is architect.

POUGKEEPSIE, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until Jan. 7, 1925, for sanitary work and electric work in the addition to water supply at the Hudson River State Hospital, Poughkeepsie.

PRATTSBURG, N. Y.—The installation of an electric light plant is under consideration by the town officials.

ROXBURY, N. Y.—The Roxbury Light & Power Company has petitioned the Public Service Commission for approval of the transfer of its property to the New York State Gas & Electric Company, Ithaca. The Roxbury company has no generating plant and purchases electricity from the Tri-County Light & Power Company, Stamford, for distribution.

SCHENECTADY, N. Y.—Application has been made to the Public Service Commission by the Adirondack Power & Light Corporation for permission to erect electric transmission and distribution lines in the towns of Stillwater and Saratoga. The company proposes to build a line through the northernly portion of the town of Stillwater to serve residents along the shore of Saratoga Lake.

STILLWATER, N. Y.—Application has been made to the Public Service Commission by the Halfmoon Light, Heat & Power Company, Mechanicsville, to extend its service in Stillwater.

STOCKHOLM, N. Y.—Permission has been granted to Edward C. Daniels, Potsdam, to erect a transmission line and distribute electricity in the town of Stockholm. The line will be about 10 miles long.

JERSEY CITY, N. J.—Plans for renovating the City Hall, at a cost of about $75,000, include the installation of new electric elevators.

NORTH BRANCH, N. J.—The New Jersey Power & Light Company, Dover, plans to extend its transmission lines to North Branch to furnish electricity for lighting residences and commercial purposes. The question of street lighting will be taken up later.

ALLENTOWN, PA.—The installation of ornamental lamps on Wyandotte and Third Streets is under consideration.

CHESTER, PA.—Plans for the proposed artificial silk mill to be erected by the Viscose Company, Marcus Hook, at or near Chester, to cost about $850,000, include a power house.

CORRY, PA.—Preliminary plans are under consideration by the City Council for further extensions to the ornamental lighting system throughout the city during 1925, to cost about $25,000.

PHILADELPHIA, PA.—Steps have been taken by the Olney Business and Improvement Association for the installation of an improved lighting system on Fifth Street from Somerville Avenue to Green Lane.

TIONESTA, PA.—The installation of a street-lighting system throughout the village, to cost about $15,000, is under consideration by the Board of Village Trustees.

WILKES-BARRE, PA.—The Hazard Manufacturing Company, manufacturer of wire rope, etc., plans to install electric power equipment in its proposed four-story plant addition, 125 ft. x 1,000 ft., for which bids will soon be asked. Fletcher-Thompson, Inc., Bridgeport, Conn., is engineer.

BELINGTON, W. VA.—The Council is negotiating for the purchase of the local electric light and water plants of the Consumers Heat, Light, Water & Power Company. If taken over, extensions and improvements will be made, including the installation of additional equipment.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, D. C., until Jan. 9, for transformers, electrical fixtures, etc. (Panama Circular 1646.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Jan. 6, for a large quantity of telephone cord, cable and wire for Eastern and Western yards (Schedule 3043), a large quantity of cable and wire for Eastern and Western yards (Schedule 3044); also for fuses and fuse elements for various yards (Schedule 3055).

## North Central States

ESCANABA, MICH.—The Chicago & Northwestern Railroad Company, Chicago, plans the installation of electric power equipment in connection with the rebuilding of its local coal docks, recently damaged by fire. The cost of the work is estimated at $500,000.

HART, MICH.—Plans are being prepared for a proposed municipal hydro-electric power plant, to cost about $130,000. Of this amount, $62,500 in bonds has already been voted. Burd & Giffels, Grand Rapids, are engineers.

IRON MOUNTAIN, MICH. — The City Council is negotiating with the Iron Mountain Electric Light & Power Company for the purchase of the local power plant, to be owned and operated by the municipality. Extensions and improvements are planned.

JACKSON, MICH.—Power rights on the Rifle River, extending from 2 miles below Sterling to near West Branch, have been purchased by the Consumers Power Company, which will construct four dams, the power to be utilized to generate electricity, which will be transmitted over high-tension transmission lines to cities of northern and central Michigan. It is estimated that a maximum of 12,000 hp. can be developed and 3,000 hp. during low-water periods.

YPSILANTI, MICH.—Plans are under way by the Ford Motor Company, Detroit, for the construction of a hydro-electric plant on the Huron River, 3½ miles from Ypsilanti. The project includes the construction of a dam and power station equipped with two turbo-generators, each of 250 hp. capacity.

CLEVELAND, OHIO.—The City Council has authorized the City Manager to invite manufacturers of traffic-signal and traffic-control devices to submit samples of their devices to the city of Cleveland and to install the same at points designated for the purpose of observation and trial.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Jan. 2, 1925, for boilers and fuel burning equipment for Kirkland station, Division of Water and Heat.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Jan. 2, 1925, for traveling screens complete for intake for the Division of Light and Power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchase and Supplies, City Hall, until Jan. 2, 1925, for traffic signal towers for the Division of Public Safety.

KENT, OHIO.—A committee has been appointed by the City Council to make investigations relative to the installation of an ornamental lighting system in Akron.

ROCK ISLAND, ILL.—The City Council has approved an ordinance authorizing the installation of an ornamental lighting system in the business district, to cost about $36,700.

AMERY, WIS.—Plans are under way by the Wisconsin Hydro-Electric Company for the construction of a large dam on the Namekagon River and the erection of a transmission line from Minong to Spooner.

BATAVIA, WIS.—The property of the Batavia Light & Power Company has been acquired by the Badger Public Service Company, Milwaukee. W. N. Albertson, First Wisconsin National Bank Building, Milwaukee, is president of the Badger company.

CEDARBURG, WIS.—A bond issue of $35,000 has been approved by the Council for extensions and improvements in the municipal electric plant.

WEYAUWEGA, WIS.—The Weyauwega Electric Light Company is making extensive improvements to its distribution system and power plant. W. N. Albertson & Company, First Wisconsin National Bank Building, Milwaukee, electrical engineers, are in charge of the work.

WITTENBERG, WIS.—Plans are under way by the Wittenberg Light & Power Company for extending its high-tension transmission line to Mattoon, Norwood and Phlox. Electricity will be supplied to residents along the line.

WITTENBERG, WIS.—The Wittenberg Light & Power Company, which recently acquired the electric plants at Aniwa and Mattoon, contemplates the erection of a transmission line between Wausau and Bernamwood.

CANNON FALLS, MINN.—The Cannon River Hydro-Electric Company has preliminary plans under advisement for the construction of a hydro-electric power plant near Cannon Falls, to cost about $250,000. J. H. A. Brahtz, Metropolitan Opera House Building, St. Paul, is engineer.

GLENCOE, MINN.—Preliminary surveys are being made for the installation of an improved lighting system in different parts of the city, to cost about $100,000. Ralph W. Richardson, Zenith Building, St. Paul, is engineer.

MOORHEAD, MINN.—The City Council contemplates extensions and improvements in the municipal electric power plant, including the installation of additional equipment.

ST. PAUL, MINN.—Bids will be received by W. H. Austin, city purchasing agent, until Dec. 30 for electrical supplies, including 2,300 globes and 100 glass canopies.

DAVENPORT, IOWA.—The erection of an office building at Second and Perry Streets, to cost about $500,000, is under consideration by the United Power & Light Company.

DEXTER, IOWA. — The Iowa Electric Company, Cedar Rapids, plans to reconstruct its transmission line from the Redfield substation to Dexter, to cost about $30,000. Improvements will also be made in the local distributing lines.

IOWA CITY, IOWA.—Improvements and extensions involving an expenditure of about $175,000 during 1925 are contemplated by the Iowa City Light & Power Company. The work will include the erection of a new high-tension transmission line from Carolville to Iowa City, a distance of 2½ miles, to cost about $69,000, and extensions to the distributing system, to cost $28,000. About $68,000 will be expended for improvements to the gas department.

ROCK VALLEY, IOWA.—The citizens have voted to grant the Northern States Power Company, Sioux Falls, a franchise to erect a transmission line through Rock Valley and to build a station to connect with the system of the Iowa Light, Heat & Power Company, Carroll, to provide emergency service here.

STRAWBERRY POINT, IOWA.—Bonds to the amount of $15,000 have been authorized for changing the system of the municipal electric plant from direct to alternating current and rebuilding the distributing system.

ST. JOSEPH, MO.—At an election held recently the voters accepted the proposal of Henry L. Doherty to furnish electricity for street-lighting. On Nov. 18 the voters defeated the proposal to issue $300,000 in bonds to rehabilitate the municipal electric generating plant.

TROY, MO.—The East Missouri Power Company has erected a transmission line to Forestell, Jonesburg, Pendelton and High Hill to supply electric service in those towns. A new street-lighting system has been installed at Warrenton, and an ornamental lighting system, consisting of twenty standards, mounted with 300-cp. lamps will be installed later. L. A. Nickell is secretary and treasurer.

## Southern States

FRANKLIN, N. C.—Bids will be received at the office of Robert & Company, Inc., Bona-Allen Building, Atlanta, Ga., engineers, until Jan. 6, 1925, as follows: For two 750-hp. water turbines with governors, two 650-kva. generators with exciters, one switchboard, two 750-kva. power transformers, etc., for the hydro-electric plant being constructed for the town of Franklin. For details see Searchlight Division.

HICKORY, N. C. — The Sandy Ridge Electric Company, recently organized, is reported to be planning the erection of a transmission line. Carl E. Probst is interested in the company.

WILSON, N. C.—The City Commission is considering issuing $60,000 in bonds for extensions to the municipal electric plant and $38,000 in bonds for an ornamental lighting system.

BATESBURG, S. C.—The citizens have voted to sell the municipal electric plant to the Broad River Power Company, Columbia. The company was also granted a franchise to operate here.

LAFAYETTE, GA.—The Lafayette Cotton Mills, Inc., is having plans drawn for the complete electrification of its plant, to replace all steam-driven apparatus. Lockwood, Greene & Company, Healey Building, Atlanta, are engineers.

MACON, GA.—The Macon Railway & Light Company plans to erect a steel-tower transmission line from the upper Flint section, via Thomaston, to Macon, about 63 miles. A substation will be built at Tenth and Turpin Streets, with initial capacity of 15,000 hp., to be increased later to 30,000 hp.

VALDOSTA, GA.—The Valdosta Lighting Company has authorized an issue of $71,000 in bonds, part of the proceeds to be used for extensions and improvements.

BOCA RATON, FLA.—The installation of an electric lighting system in Boca Raton is under consideration.

DELAND, FLA.—Bonds to the amount of $300,000 have been voted for the construction of a municipal electric plant and distributing system.

LAKELAND, FLA.—Extensions and improvements to the munipical electric light plant, to cost about $160,000, are under consideration.

TAMPA, FLA. — The Tampa Electric Company is considering the construction of a dam to replace the present dam on the upper Hillsborough River.

HOHENWALD, TENN.—The City Council is considering a proposal submitted by W. P. Grover and J. W. Floyd, both of Hohenwald, to install an electric plant and waterworks system in Hohenwald.

FLORENCE, ALA.—Bids will be received by the United States Engineer until Dec. 31 for 680 porcelain insulators (Circular 262); also, until Jan. 6, for 233 control conduit hangers, hangers, brackets, etc. (Circular 263).

RIVER FALLS, ALA.—The River Falls Power Company, which is building a hydro-electric plant at River Falls, plans to erect a transmission line (75 miles long) connecting River Falls, Gantt, Andalusia, Doxier, Brantley, Glenwood, Luverne, Red Level and Enterprise. The cost is estimated at $150,000.

BLYTHEVILLE, ARK.—Benjamin Stover is planning the construction of an electric power station to cost about $20,000, to replace a plant lately destroyed by fire.

COTTONPORT, LA. — The construction of an electric light plant and waterworks system is under consideration by the Council.

HOUMA, LA.—The City Council has disposed of a bond issue of $100,000, part of the proceeds to be used for extensions and improvements in the municipal electric plant.

JONESVILLE, LA.—The Town Council is considering calling an election to vote on the proposal to issue bonds for an electric plant and sewerage system.

NEW ORLEANS, LA.—Bids will be received by the secretary of the Sewerage and Water Board, 526 Carondelet Street, until Jan. 26, for two 1250-hp. and two 350-hp. motors, with switchboard, cables, instruments, etc.

PERRY, OKLA.—Extensions are contemplated to the municipal electric power plant, including generator, Diesel oil engines and accessory apparatus.

RALSTON, OKLA.—The Fairfax (Okla.) Electric Light, Heat & Power Company plans to erect a transmission line from Fairfax to Ralston, estimated to cost about $25,000.

ABILENE, TEX.—Plans are being considered by the West Texas Utilities Company for extensions of its transmission lines to connect up with the plants and system of the Interstate Electric Corporation of San Angelo, recently acquired. The central power stations at San Angelo and Abilene will be enlarged.

COLEMAN, TEX.—Improvements to the municipal electric plant, to cost about $21,000, are under consideration by the City Commissioners.

EAGLE PASS, TEX.—Kifuri Brothers contemplate the construction of a steam-operated electric power plant on a tract of land near the city where an industrial community is to be established.

KARNES CITY, TEX.—The local electric light and ice plant has been acquired by E. A. Clousniter, Kenedy.

## Mountain and Pacific States

AMERICAN LAKE, WASH.—Bids will be received by the United States Veterans' Bureau, Arlington Building, Washington, D. C., until Dec. 30, for a refrigerating plant at the local veterans' hospital, No. 94.

CENTRALIA, WASH. — The Puget Sound Power & Light Company, Seattle, has applied to the County Commissioners for permission to erect a transmission line over certain county roads in the Hannaford Valley northeast of Centralia.

CLARKSTON, WASH.—Surveys are being made by the Pacific Power & Light Company, Portland, Ore., for the erection of a 66,000-volt transmission line from Pataha City to Clarkston, a distance of about 30 miles, where it will connect with the lines of the Washington Power Company.

PORT ANGELES, WASH. — The proposal to install an improved lighting system on various downtown streets has been indefinitely postponed.

TACOMA, WASH. — The City Council has approved the installation of ornamental lamps on various streets, totaling 203 concrete standards, for which specifications will soon be prepared.

TACOMA, WASH. — Plans have been completed for the proposed substation in connection with the Lake Cushman project. This station will be the Tacoma terminal

for all transmission lines from the Cushman hydro-electric plant. The cost complete with equipment is estimated at about $550,000. Bids, it is expected, will soon be asked for.

GRANTS PASS, ORE.—The California-Oregon Power Company, San Francisco, is planning to rebuild its transmission line to Ray Gold, Ore., about 24 miles, for increased voltage, to cost about $75,000.

RIDDLE, ORE.—The construction of a transmission line up the Azalea River, a distance of about 4 miles, is under consideration by the city officials.

WINCHESTER, ORE. — James R. Wheeler, Winchester, and associates have applied to the state for permission to construct and operate a hydro-electric power plant on Mills Creek, Douglas County, with initial capacity of 1,500 hp., to cost about $60,000.

GLENDALE, CAL.—The City Council has approved the installation of ornamental lamps on Harvey Drive, from Wilson Avenue to Hill Drive, and on portions of Hill and Summit Drives and Broderick Avenue.

GLENDALE, CAL.—The State Railroad Commission has granted the Southern California Edison Company, Los Angeles, permission to sell its electrical system, located in the territory recently annexed to the city, to the municipality of Glendale.

HEALDSBURG, CAL.—Plans are being prepared for the installation of a new lighting system for the business district, to cost about $25,000.

LOS ANGELES, CAL.—The City Council has approved ordinances for the installation of ornamental lamps on Kingsley Drive from Beverly to Wilshire Boulevards and on Barton Avenue from Seward Street to Las Palmas Avenue, concrete standards to be used.

PINE KNOT, CAL.—Permission has been granted the Bear Valley Utility Company to issue $115,000 in bonds and $43,000 in capital stock, the proceeds to be used for extension to its electric transmission lines and the construction of a complete water system.

RED BLUFF, CAL.—The Pacific Gas & Electric Company plans to build a substation within the city limits, to cost about $49,000, and to erect a detour power line (4 miles long) around the west side of the city, to cost about $33,000.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 6, for 1,650 ft. three-conductor cable, three oil fuse cut-outs, three disconnecting switches and one switchboard panel, for the Mare Island Navy Yard (Schedule 3051); also, at the same time, for 2,040 single-pole switches, for the Mare Island and Puget Sound yards. (Schedule 3057.)

SANTA BARBARA, CAL.—The installation of a street-lighting system on State Street, to cost about $26,500, is under consideration.

SANTA BARBARA, CAL. — The City Council authorized an election to be held Feb. 24, 1925, to submit the proposal to issue $495,000 in bonds, the proceeds to be used to establish a municipal power plant and distribution lines for the Cabrillo Park purchase, Carrillo Street viaduct and approaches.

PHŒNIX, ARIZ.—The Salt River Valley Users' Association plans to install electrically operated pumps in connection with extensions to its irrigation system, to cost about $450,000.

SHERIDAN, WYO. — Bids will be received by the United States Veterans' Bureau, Arlington Building, Washington, D. C., until Dec. 30, for an ice-manufacturing plant at the local veterans' hosiptal, No. 86.

LAS ANIMAS, COL. — The Western Public Service Company, Colorado Springs, contemplates improvements to its local lines, to cost about $23,000.

## Canada

DUNCAN, B. C.—In a report submitted to the Council by A. C. Yuill relative to increasing the output of the municipal electric plant, the installation of a Diesel-engine-driven unit is recommended. The cost is estimated at $39,340.

VANCOUVER, B. C.—Plans have been approved by the City Council for the installation of ornamental lamp standards on several streets, to cost about $86,000.

VANCOUVER, B. C. — The Capilano Timber Company plans to install electric power equipment in its proposed mill on the Capilano River, the initial unit being estimated to cost $400,000 and complete plant about $1,000,000.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued December 12, 1924)

1,517,247. DISTRIBUTING SYSTEM; Herbert Pearce, Stretford, England. App. filed May 22, 1920. Protective gear for alternating-current systems.

1,517,249. ELECTRIC RELAY; Bruno Rosenbaum, Berlin, Germany. App. filed Nov. 1, 1921. Electrostatic relay.

1,517,252. TROLLEY SPLICER; William Schaake, Pittsburgh, Pa. App. filed Jan. 7, 1922. For securing the ends of two trolley conductors together.

1,517,257. TELEPHONE-EXCHANGE SYSTEM; Frederick J. Scudder, Queens, Long Island, N. Y. App. filed Sept. 22, 1921. Machine switching.

1,517,258. THERMAL RELAY; Benjamin H. Smith, Wilkinsburg, Pa. App. filed June 9, 1920. Embodying bimetallic members.

1,517,260. TELEPHONE-EXCHANGE SYSTEM; Franklin A. Stearn, Paterson, N. J. App. filed Dec. 30, 1921. Automatic.

1,517,265. AUTOMATIC TELEPHONE SWITCH; Herbert B. Taylor, Westfield, N. J. App. filed Jan. 7, 1922.

1,517,266. LINE-FINDER SWITCH; Albert D. Thomas, Paris, France. App. filed Aug. 31, 1921. For semi-automatic or automatic telephone system.

1,517,276. CONTROL OF ELECTRIC LIFTING MAGNETS; Wilfrid Brooke, Hale, England, and Henry E. Bowen, Sheffield, England. App. filed July 28, 1921.

1,517,277. SIGNALING SYSTEM; Omar B. Buchanan, Wilkinsburg, Pa. App. filed Aug. 18, 1921. With means for controlling the radiation of energy.

1,517,280. RELAY SYSTEM; Leslie N. Crichton, Edgewood, Pa. App. filed Sept. 8, 1921. Direct-trip system in which energy for tripping an interrupter may be derived from the circuit to which the circuit interrupter is connected.

1,517,281. DYNAMO; Louis B. Ehrlich, Brookline, Mass. App. filed Jan. 28, 1924. With brush rigging for angularly adjusting one or more of the brush holders.

1,517,283. AUTOMATIC TELEPHONE SYSTEM; Ralph W. Engsberg, Oak Park, Ill. App. filed Sept. 29, 1923.

1,517,290. SYSTEM OF CONTROL; Lloyd J. Hibbard, Wilkinsburg, Pa. App. filed Nov. 13, 1919. Regenerative control of alternating-current motors of the commutator type.

1,517,301. LIQUID HEATER; Harvey F. McMichael and Josh H. Lee, Timpas, Col. App. filed Feb. 18, 1924. Of the immersion type.

1,517,306. INCLOSED VENTILATED MOTOR; Chester B. Mills, East McKeesport, Pa. App. filed Nov. 21, 1918.

1,517,311. ELECTRODE FOR ELECTRIC ARC WELDING; Georges Motte, Brussels, Belgium. App. filed Jan. 5, 1923.

1,517,315. TELEPHONE-EXCHANGE SYSTEM; William A. Rhodes, New York, N. Y. App. filed Dec. 6, 1920. Automatic.

1,517,331. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Oct. 23, 1922. Automatic switching apparatus employed either entirely or in part.

1,517,353. ELECTRICAL FIXTURE; Walter U. Forschler, Norwich, Conn. App. filed April 8, 1922. With receptacle and light fixture connected to a single outlet box.

1,517,367. FUSE PLUG; Eric G. Larson, Salt Lake City, Utah. App. filed Jan. 26, 1923. Renewable.

1,517,370. RADIO CONDENSER; Ralph E. Marbury, Edgewood Park, Pa. App. filed Nov. 26, 1920. Embodying a solid dielectric.

1,517,381. SYSTEM OF TELEGRAPH DISTRIBUTION; Louis M. Potts, Baltimore, Md. App. filed March 31, 1919.

1,517,382. SUBSTATION CIRCUIT; Winfred T. Powell, Rochester, N. Y. App. filed March 8, 1920. Automatic telephone system.

1,517,425. AUTOMATIC TELEPHONE SWITCH; Charles J. Hendrickson and Victor F. Miller, New York, N. Y. App. filed Jan. 7, 1922.

1,517,465. TROLLEY HEAD; Louis Sabo, Carolina, W. Va. App. filed Aug. 21, 1924. With two trolley-wire engaging wheels.

1,517,466. GASEOUS-CONDUCTION LAMP; Otto Schaller, Berlin-Sudende, and Fritz Schroter, Berlin-Schmar-Gandorf, Germany. App. filed July 22, 1920.

1,517,477. CIGAR LIGHTER; Thomas White, Detroit, Mich. App. filed March 10, 1922.

1,517,532. AUTOMATIC INTERRUPTER FOR ELECTRIC CIRCUITS; Georg Buschelberger, Frankfort-on-the-Main, Germany. App. filed Dec. 2, 1921. Miniature circuit breaker connected in the circuit like a screw-base fuse plug.

1,517,541. PRESSURE-CONTROL DEVICE FOR SWITCHES; James H. Dennedy, Detroit, Mich. App. filed June 29, 1922.

1,517,566. SPARK GAP; Robert H. Marriott, Bremerton, Wash. App. filed Nov. 1, 1921. Quenched spark gap for radio transmission.

1,517,567. ELECTRIC SWITCH; Ralph K. Mason, Bantam, Conn. App. filed July 13, 1921. Safety type.

1,517,568, 1,517,569. SYSTEM OF RADIO TRANSMISSION; Joseph O. Mauborgne and Guy Hill, Washington, D. C. App. filed June 16, 1920.

1,517,570. SYSTEM OF RADIO COMMUNICATION; Joseph O. Mauborgne, Chicago, Ill., and Guy Hill, Washington, D. C. App. filed Feb. 17, 1921. Using an open antenna circuit.

1,517,578. SWITCH HOUSING; William V. Orr, Cleveland, Ohio. App. filed May 27, 1921. Primarily for use in connection with domestic electric machinery.

1,517,584. THEFT-PROOF ELECTRIC LIGHT BULB; Wilbur M. Reece, Enterprise, Ore., and Carl E. Tomlinson, Chehalis, Wash. App. filed July 26, 1923.

1,517,630, 1,517,631. ANODE FOR USE IN ELECTROPLATING; Giraldus Jones, Birmingham, England. App. filed Dec. 13, 1923.

1,517,636. ELECTRIC CONTACT DEVICE WORKING WITH A LIQUID, ESPECIALLY MERCURY; Karl Kaisser, Munich, Germany. App. filed July 26, 1922.

1,517,638. ELECTRIC SWITCH; Louis Kellner, Brooklyn, N. Y. App. filed April 6, 1922. Quick-make and quick-break type.

1,517,652. RECORDING MECHANISM; Frank W. Quarles, Baltimore, Md. App. filed March 15, 1922. Means for periodically operating a bail to press a stylus or other marker upon a record.

1,517,654. WIRELESS SIGNALING SYSTEM; Henry J. Round, London, England, and Archibald McLellan, Swansea, England. App. filed March 30, 1921.

1,517,660. ELECTROLYTE; Henry H. Williams, Abilene, Tex. App. filed June 20, 1923. For lead storage batteries.

1,517,667. MEASURED-SERVICE TELEPHONE; Arthur M. Crichton, Uniontown, Pa. App. filed Oct. 16, 1920.

1,517,680. PLUG CLUSTER; Arthur P. Leinen, Chicago, Ill. App. filed May 28, 1920.

1,517,683. PULL-SWITCH CLUSTER; Paul D. Phillips, Elmhurst, Ill. App. filed Sept. 7, 1920.

1,517,684. PUSH-TYPE FLUSH RECEPTACLE FOR ELECTRIC INSTALLATION; Adolph C. Recker, Oakville, Conn. App. filed July 2, 1920.

1,517,688. SWIVEL-SHELL ATTACHMENT PLUG; Chester E. Warner, Berwyn, Ill. App. filed Aug. 18, 1920.

1,517,714. ELECTRIC SIGNALING MEANS AND SYSTEM; Lewis Degen, Berkeley, Cal. App. filed Dec. 13, 1921. Applicable to fire-alarm systems, etc.

1,517,727. ELECTRODE FOR THE OXIDATION OF NITROGEN; Birger F. Halvorsen Christiania, Norway. App. filed Feb. 6, 1923.

1,517,738. HEATER; Charles F. Loker, Tonopah, Nev. App. filed Feb. 16, 1923. Having a casing through which air will readily flow by natural draft and provided with baffle plates.

1,517,754. TELEPHONE; Hans Riegger, Berlin-Charlottenburg, Germany. App. filed March 24, 1921. Loud-speaking type.

1,517,756. TROLLEY HARP AND TROLLEY HEAD; Ralph Santoro, Philadelphia, Pa. App. filed Sept. 10, 1924.

1,517,759. REFLECTING HEATER; Milton H. Shoenberg, San Francisco, Cal. App. filed Nov. 7, 1923.

1,517,770. ELECTROMAGNET; Alfred A. Ziegler, Boston, Mass. App. filed Nov. 1, 1919. With means for securing the ends of the coil wires and the lead wires in conductive relation with each other.

1,517,800. SOCKET AND RING; William M. Parker, Parkersburg, W. Va. App. filed July 10, 1922. On a two-way plug.

1,517,811. SWITCHING HANDLE; Olo C. Willis, Cleveland, Ohio. App. filed May 1, 1920. For use with electrical appliances as suction cleaning apparatus.

1,517,816. RADIO TRANSMITTING SYSTEM; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed June 24, 1921. Directive type.

1,517,819. METHOD OF PRODUCING CARBON ELECTRODES AND THE PRODUCT THEREOF; Hans Beer, Ratibor, Upper Silesia, Germany. App. filed April 17, 1924.

# Financial and Corporate

## Utility Stocks Jump

**New Record Peaks Established Over Entire List as Trading Turns Brisk**

IN THE week that ended December 20 power and light stocks ran into another such market as they had earlier in the year. Prices soared to new high levels in numerous sections of the list as stocks were accumulated in some cases and manipulated in others. Perhaps the most interesting rise of the week was that in Southeastern Power & Light common, which, simultaneously with news of progress for the Underwood Muscle Shoals bill, moved quickly from 42 to 65. The price of 65 is the equivalent of 130 for the old Alabama Traction, Light & Power Company's stock that sold earlier in 1924 as low as 24. Tennessee Electric likewise was strong and set a new top above 52.

American Power & Light common rose briskly to as high as 68 and a fraction. This compares with 680 for the old stock, which sold around 198 a year ago. Adirondack Power & Light, which for some time had held around 32 or below, moved up to 38. Lehigh Power Securities sold earlier in 1924 as low as 31 and sold a week ago at 89, but now has established a new high at par. Similarly National Power & Light has reached and crossed 200. General Gas & Electric was one of the favorites of the week, the stock jumping over ten points to 80 as compared with the year's low at 15.

One of the advances that attracted attention was the renewed strength in Commonwealth Power Corporation's common shares after they had added something like twenty points to what for weeks had been their market level. After running from par to 122, Commonwealth Power last week added another ten points to its price. Considerable activity has developed in some of the cheaper issues, and Electric Investors, Inc., was very strong.

## New Capital Issues

The outstanding feature of the past week's new financing was the twelve-and-a-half-million-dollar offering issued by the Philadelphia Electric Company in the form of 5 per cent first lien and refunding mortgage gold bonds, the price being 99½ and interest to yield about 5.03 per cent. The proceeds from the sale of these bonds will be devoted to construction purposes. The financial set-up of this utility is discussed at length elsewhere in this issue. The Associated Gas & Electric Company participated in the week's activities by offering 20,000 shares of preferred stock of no par value at $50 per share and accrued dividend with the object of reimbursing the treasury of the company for expenditures against new properties serving thirty-six communities in Tennessee, Connecticut and upstate New York. Upon completion of present financing the Associated will have outstanding 90,000 shares of preferred stock and $4,000,000 secured gold bonds. Among smaller issues were the Indiana General Service Company's 5 per cent gold bonds, totaling $884,000, offered at 94½ and interest. A Canadian company, the Canada Northern Power Corporation, Ltd., floated an issue of 7 per cent cumulative preferred stock to the amount of $3,500,000 at 99 to yield over 7 per cent. The company, as was announced in a recent number of ELECTRICAL WORLD, was formed from the consolidation of several companies, including Great Northern Power Company and Northern Canada Power Company.

## Company Reports

Among the company reports issued during the past week for the month of November are the following:

| Name of Company | Gross Revenues for November 1924 | 1923 |
|---|---|---|
| Adirondack Power & Light | $664,420 | $636,536 |
| Appalachian Power | 338,815 | 302,397 |
| Cities Service | 1,259,961 | 1,181,824 |
| Columbia Gas & Electric | 2,140,499 | 1,855,547 |
| Eastern Shore Gas & Electric * | 53,930 | 50,214 |
| Eastern Texas Elec. and subs.* | 202,573 | 170,795 |
| Grafton Co. Elec. Lt. & Pwr. | 21,564 | 20,602 |
| Galveston-Houston Electric and subs * | 344,405 | 283,193 |
| Massachusetts Lighting | 313,694 | 310,502 |
| Niagara, Lockport & Ontario Power | 551,633 | 499,792 |
| Penn Central Light & Power* | 315,686 | 297,884 |
| Public Service of New Jersey | 7,673,356 | 6,965,274 |
| Republic Railway & Light | 883,534 | 877,587 |
| United Gas & Electric | 1,221,595 | 1,205,155 |

*October.

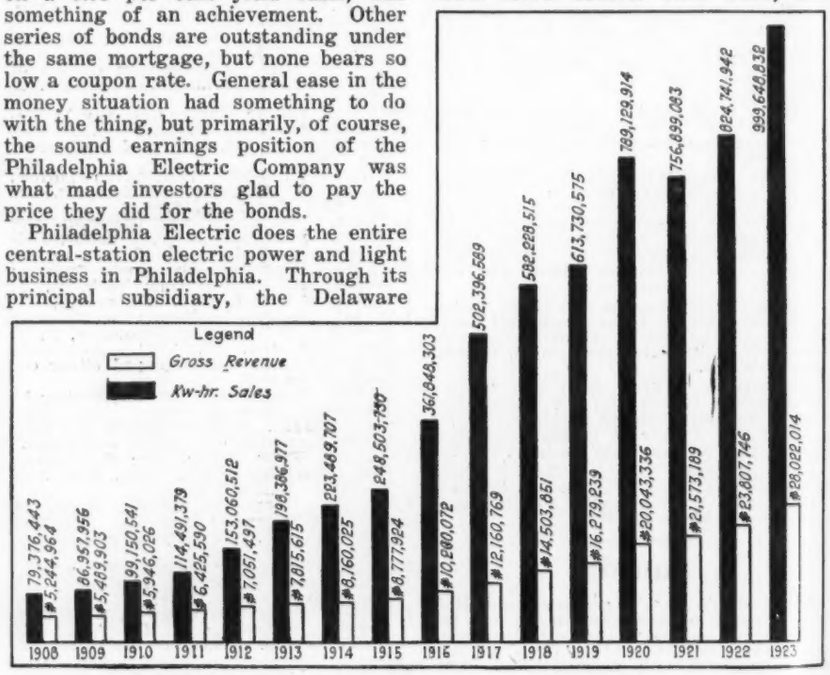
# Philadelphia Electric Company

**This Strong Company, Doing the Entire Power and Light Business in the Country's Third Largest City, Has Grown Enormously**

BY PAUL WILLARD GARRETT

THE Philadelphia Electric Company's ability last week to market a twelve-and-a-half-million-dollar issue of its first lien and refunding mortgage 5's of 1960 at 99½ to investors, or on a 5.03 per cent yield basis, was something of an achievement. Other series of bonds are outstanding under the same mortgage, but none bears so low a coupon rate. General ease in the money situation had something to do with the thing, but primarily, of course, the sound earnings position of the Philadelphia Electric Company was what made investors glad to pay the price they did for the bonds.

Philadelphia Electric does the entire central-station electric power and light business in Philadelphia. Through its principal subsidiary, the Delaware County Electric Company, it also does the entire power and light business in an important manufacturing district southwest of Philadelphia along the Delaware River. Only two or three other power and light companies can be compared with the Philadelphia Electric Company from the standpoint of size of the territory served. These are Brooklyn Edison and New York Edison, which serve Greater New York, and the Commonwealth Edison, which serves Chicago. Altogether the Philadelphia Electric Company serves more than two million people.




THE GROSS REVENUE OF THE PHILADELPHIA ELECTRIC COMPANY HAS SHOWN A CONSISTENT ANNUAL GROWTH

Records of the Philadelphia Electric

# Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.

| Companies | Bid Price Saturday, Dec. 20 | Low 1924 | High 1924 |
|---|---|---|---|
| **PREFERRED STOCKS** | | | |
| **Operating Companies** | | | |
| Adirondack Power & Light 7 per cent | a 98½ | 94 | 98½ |
| Appalachian Power, 7 per cent | a 93 | 85½ | 93 |
| Arkansas Light & Power 7 per cent | a 94 | 81 | 96 |
| Asheville Power & Light 7 per cent | a 95 | 95 | 99 |
| Central Illinois Public Service 6 per cent | a 85 | 84 | 88 |
| Colorado Power 7 per cent | a 92 | 90 | 98 |
| Connecticut Light & Power 7 per cent | a105 | 99 | 106 |
| Consumers' Power 6 per cent | a 90 | 85 | 93 |
| Dayton Power & Light 6 per cent | a101 | 84 | 101 |
| Duquesne Light 7 per cent | 105½ | 102 | 108½ |
| Eastern Texas Electric 6 per cent | a101 | 81 | 105 |
| Empire District Electric 6 per cent | a 77 | 70 | 78 |
| Fort Worth Power & Light 7 per cent | a 99 | 97 | 103 |
| Great Western Power 7 per cent | 97 | 96 | 99 |
| Illinois Northern Utilities 6 per cent | a 86 | 82 | 87 |
| Illinois Power & Light 7 per cent | a 92 | 84 | 95 |
| Kansas Gas & Electric 7 per cent | a 94 | 92 | 97 |
| Long Island Lighting 7 per cent | 97 | 95½ | 102 |
| Minnesota Power & Light 6 per cent | 89 | 78 | 90 |
| Mississippi River Power 6 per cent | a 88 | 80 | 90 |
| Nebraska Power 7 per cent | 96 | 89 | 99 |
| Niagara Falls Power—25 | a 28 | 27 | 29 |
| Niagara, Lockport & Ont. Power 7 per cent | a104 | 99 | 107 |
| Northern States Power 7 per cent | a 96 | 91 | 97 |
| Ohio Public Service 7 per cent | a 93 | 86 | 100 |
| Pacific Gas & Electric 6 per cent | a 94 | 85 | 94 |
| Penn-Ohio Power & Light 7 per cent | 92 | 84 | 96½ |
| Pennsylvania Power & Light $7—no par | 98 | 93 | 99½ |
| Penn. Public Service 7 per cent | a 90 | 90 | 100 |
| ‡Philadelphia Electric 8 per cent—25 | a 37½ | 29¾ | 39¾ |
| Southern California Edison 8 per cent | a115 | 112 | 120 |
| Tennessee Electric Power, 6 per cent | a 73 | 47 | 73 |
| Texas Power & Light 7 per cent | 97 | 95 | 97½ |
| Utah Power & Light 7 per cent | 95 | 94 | 96½ |
| Western States Gas & Electric 7 per cent | a 84 | 78 | 86 |
| Yadkin River Power, 7 per cent | 97½ | 94 | 99 |
| **Holding Companies** | | | |
| American Gas & Electric 6 per cent—50 | a 46 | 41½ | 46 |
| American Light & Traction | a 94 | 91 | 94½ |
| American Power & Light 6 per cent | a 88 | 84 | 91 |
| American Public Service 7 per cent | a 88 | 84 | 95 |
| American Public Utilities 7 per cent | a 88 | 73 | 88 |
| American Water Works & Electric 7 per cent | a 100¼ | 89½ | 101 |
| Associated Gas & Electric 7 per cent—1 per cent extra—50 | a 49 | 42 | 52 |
| Carolina Power & Light 7 per cent | a100 | 95½ | 101 |
| Central Indiana Power 7 per cent | a 88 | 80 | 93 |
| Cities Service 6 per cent | a 80½ | 67 | 83 |
| Commonwealth Power 6 per cent | a 82½ | 72 | 82½ |
| Consolidated Gas 6 per cent—50 | a 58 | 51 | 59½ |
| Continental Gas & Electric 7 per cent pr. pf | a 90 | 69 | 93 |
| Electric Bond & Share 6 per cent | a102 | 96½ | 104 |
| General Gas & Electric—$8—no par | a104 | 96 | 105 |
| *Middle West Utilities 7 per cent | a 93 | 80 | 93 |
| National Power & Light—$7—no par | a 93½ | 84 | 96½ |
| North American 6 per cent—50 | a 46½ | 43¾ | 50½ |
| Northern Ohio Electric | a 25 | 16 | 34 |
| Public Service Corp. of N. J. 7 per cent | 99 | 96½ | 101¼ |
| Public Service Corp. of N. J. 8 per cent | a112½ | 99½ | 115 |
| Standard Gas & Electric 8 per cent—50 | 50 | 46½ | 50 |
| †United Gas Improvement—50 | a 57½ | 55¼ | 58 |
| United Light & Power—$6.50—no par | 83 | 75¼ | 84 |
| **COMMON STOCKS** | | | |
| **Operating Companies** | | | |
| Adirondack Power & Light—50 | a 36 | 22½ | 36 |
| Appalachian Power—no par | a 72 | 66 | 93 |
| Arkansas Light & Power | a 60 | 22 | 63 |
| Brooklyn Edison | a120½ | 107½ | 124½ |
| Buffalo General Electric | a190 | 118 | 190 |
| Colorado Power | a 33 | 21 | 35 |
| *Commonwealth Edison | a135 | 126 | 136½ |
| §Consolidated Gas, Electric Light & Power | a 33⅜ | 32½ | 37½ |
| Dayton Power & Light | a175 | 70 | 180 |
| Detroit Edison | a112⅜ | 102½ | 115¾ |
| \|\| Edison Electric Illuminating of Boston | a197 | 163½ | 197 |
| Long Island Lighting | 200 | 100 | 200 |
| Mississippi River Power | a 33 | 18 | 35 |
| Montana Power | a 71 | 61¼ | 74¾ |
| Niagara Falls Power—no par | a 42 | 42 | 47 |
| Niagara, Lockport & Ontario Power—no par | a 53 | 42 | 53 |
| Northern Ohio Electric—no par | a 8 | 5 | 16 |
| Northern States Power | a104 | 92 | 106 |
| North Texas Electric | a 70 | 58 | 84 |
| Pacific Gas & Electric | a103½ | 90½ | 104½ |
| ‡Penn Central Light & Power—no par | 60½ | 57 | 60½ |
| §Pennsylvania Water & Power | a127½ | 98½ | 135½ |
| ‡Philadelphia Electric—25 | a 38½ | 29 | 39¾ |
| *Public Service Co. of Northern Illinois | 111½ | 99 | 111½ |
| Puget Sound Power & Light | a 49 | 43½ | 61½ |
| Southern California Edison | a101½ | 95 | 106 |
| Tampa Electric | a170 | 134 | 170 |
| Tennessee Electric Power—no par | 38½ | 20 | 41 |
| Virginia Power | a 70 | 16 | 70 |
| Virginia Railway & Power | a 72 | 36 | 72¾ |
| West Penn. Co. | 118 | 47½ | 121 |
| **Holding Companies** | | | |
| ‡American Electric Power—50 | 61 | 22½ | 62½ |
| American Gas & Electric—no par | a 82 | 43½ | 115 |
| American Light & Traction | a140 | 115 | 148 |
| American Power & Light | a 66 | 34½ | 66 |
| American Public Utilities | a 75 | 35 | 97 |
| American Water Works & Electric | a 39½ | 24 | 41¾ |
| Carolina Power & Light—no par | a328 | 82½ | 330 |
| Cities Service | a174 | 140 | 187 |
| Columbia Gas & Electric—no par | a 47 | 33 | 47½ |
| Commonwealth Power Corp.—no par | a126 | 56 | 126 |
| Consolidated Gas—no par | a 77 | 60¼ | 79¼ |
| Continental Gas & Electric | a 84 | 49 | 96 |
| Federal Light and Traction | a115 | 75 | 122½ |
| General Gas & Electric | a 75 | 22 | 75 |
| Lehigh Power Securities—no par | a 96 | 31 | 96 |
| *Middle West Utilities—no par | a 80 | 41 | 86 |
| National Power & Light—no par | a207 | 60 | 207 |
| Philadelphia Co.—50 | a 55½ | 42¾ | 56¾ |
| Power Securities—no par | a 18 | 4 | 18 |
| Public Service Corp. of N. J.—no par | a 68½ | 39 | 69½ |
| Standard Gas & Electric—no par | a 40¼ | 31½ | 41⅝ |
| United Gas & Electric (Conn.)—no par | a 31 | 14 | 42 |
| Utah Securities | a 43½ | 16½ | 46 |
| **BONDS** | | | |
| **Operating Companies** | | | |
| Adirondack Power & Light 6s | 1950 | a102½ | 97½ 103 |
| Alabama Power 5s | 1946 | a 95½ | 90½ 97 |
| Appalachian Power 5s | 1941 | a 95½ | 89 96 |
| Brooklyn Edison 5s | 1949 | a100 | 97½ 102½ |
| 6s | 1930 | 103½ | 102½ 106½ |
| 7s | 1940 | 107¾ | 107 110½ |
| Cleveland Electric Illuminating 5s | 1939 | a 99½ | 98½ 101 |
| Commonwealth Edison 5s | 1943 | a 99¾ | 95 101 |
| 5s | 1953 | a 98½ | 92 99½ |
| §Consol. Gas, Elec. Lt. & Pwr. 4½s | 1935 | a 92½ | 91 96 |
| 6s | 1949 | a105 | 102¾ 106 |
| Consumers' Power 5s | 1936 | a 98½ | 94½ 99½ |
| 5s | 1952 | a 92 | 87 92¾ |
| Detroit Edison 5s | 1933 | a100½ | 99 101½ |
| Duquesne Light 6s | 1949 | a106 | 103½ 106½ |
| Great Western Power 5s | 1946 | 95 | 90½ 96 |
| Kansas City Power & Light 5s | 1952 | a 96¾ | 89 96¾ |
| Mississippi River Power 5s | 1951 | a 97¾ | 92 97½ |
| Montana Power 5s | 1943 | a 97¾ | 95 99 |
| New England Power 5s | 1951 | a100 | 97 101½ |
| New York Edison 6½s | 1941 | a113½ | 109¾ 114½ |
| Niagara Falls Power 6s | 1950 | a105½ | 104 106 |
| Northern States Power 5s | 1941 | a 93½ | 89½ 94½ |
| 6s | 1941 | a104 | 101 105 |
| Ohio Power 7s | 1951 | a106½ | 103 107 |
| Pacific Gas & Electric 5s | 1942 | a 94½ | 90½ 95 |
| Pennsylvania Water & Power 5s | 1940 | a 99½ | 96 100 |
| ‡Philadelphia Electric 5s | 1966 | a101½ | 97 103½ |
| 5½s | 1947 | a104¾ | 99½ 105 |
| 6s | 1941 | a106½ | 103½ 107¾ |
| Portland Electric Power 6s | 1947 | a 94½ | 89½ 97 |
| Southern California Edison 5s | 1939 | a 99½ | 96 100 |
| 6s | 1944 | a102½ | 100 103½ |
| Tennessee Electric Power 6s | 1947 | a 99½ | 93½ 99½ |
| Texas Power & Light 5s | 1937 | 96½ | 91½ 97 |
| Toledo Edison 7s | 1941 | a109½ | 106 110 |
| Utah Power & Light 5s | 1944 | a 91½ | 87½ 93½ |
| **Holding Companies** | | | |
| Alabama Traction, Light & Power 5s | 1962 | a 85½ | 65½ 86 |
| American Gas & Electric 6s | 2014 | a 94½ | 94 95½ |
| American Power & Light 6s | 2016 | a 93½ | 91 94½ |
| Amer. Water Works & Electric 5s | 1934 | a 92½ | 84½ 94 |
| Associated Gas & Electric 6½s | 1954 | 94 | 92½ 94½ |
| Central Indiana Power 6s | 1947 | a 95 | 88 96½ |
| Commonwealth Power 6s | 1947 | a 97½ | 87 98 |
| Consolidated Cities Lt., Pwr. & Tr. 5s | 1962 | a 76 | 64 76½ |
| Illinois Power & Light 6s | 1953 | a101 | 95 101 |
| United Light & Railways 5s | 1932 | 94 | 87½ 94½ |
| 6s | 1952 | 96 | 92 97½ |
| **ELECTRICAL MANUFACTURING COMPANIES** | | | |
| **PREFERRED STOCKS** | | | |
| Allis-Chalmers Manufacturing | | a104¾ | 90 104¾ |
| *National Carbon | | 122 | 112 125 |
| Worthington Pump & Machinery—A | | 89½ | 68 89½ |
| **COMMON STOCKS** | | | |
| Allis-Chalmers Manufacturing | | a 72 | 41½ 72¼ |
| American Bosch Magneto—no par | | a 33 | 22½ 38¾ |
| Electric Storage Battery—no par | | c 65½ | 50½ 66 |
| General Electric | | a296½ | 193½ 296½ |
| General Electric—10 | | a 11½ | 10¼ 11½ |
| *Hurley Machine—no par | | a 60 | 48 66 |
| †Wagner Electric | | 27 | 20 34½ |
| Westinghouse Electric & Manufacturing—50 | | a 69 | 55½ 70¼ |
| Worthington Pump & Machinery | | a 72¾ | 23½ 74 |
| **BONDS** | | | |
| Canadian General Electric 6s | 1942 | a107½ | 102¾ 107¾ |
| General Electric 3½s | 1942 | 84½ | 80 84½ |
| 5s | 1952 | a105 | 100 105¾ |
| Robbins & Myers 7s | 1952 | 65 | 65 91½ |
| †Wagner Electric Manufacturing 7s | .... | 101 | 97 101½ |
| Western Electric 5s | 1944 | a 98¾ | 96 99½ |
| Westinghouse Electric & Mfg. 7s | 1931 | a107½ | 106½ 109½ |

* Chicago Stock Exchange. † St. Louis Stock Exchange. ‡ Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange
a Bid price Tuesday, December 23.

Company system show some unusual figures on growth. The number of customers has increased from 24,868 in 1908 to 305,644 in 1923. In the same period the connected kilowatt load has increased from 87,928 to 701,393 and the total number of kilowatt-hour sales from 79,376,443 to 999,648,832. Gross revenues have increased fivefold during the last sixteen years, or from $5,244,064 in 1908 to $29,639,099 for the twelve months ended October 31, 1924.

From $29,639,099 of gross revenues for the twelve months ended October 31 the system set aside $17,180,061 for operation, taxes and for maintenance. Counting $348,144 of non-operating income, there was available for interest charges $12,807,182. In that figure lies the significance of the earnings from the standpoint of bondholders. Philadelphia Electric Company's annual interest charges on all bonds presently to be outstanding will be $4,203,024. In other words, net earnings in the twelve months ended October 31 were enough to cover interest charges on the enlarged volume of bonds more than three times.

### A WORD ABOUT THE PROPERTIES

The present installed generating capacity of the company's plants is 476,480 kw., of which 90,000 kw., or about a fifth, was placed in operation this year. Three of the country's largest and most efficient generating plants are to be found in the Philadelphia system, which is, incidentally, all interconnected. Foundations are being laid, however, for still another large station, and the proceeds of the new bonds are to be used in part for the installation of the first 100,000 kw.

The excellent earnings and property values that lie back of Philadelphia Electric bonds are what give them rank among our best power and light obligations. Dividends have been paid on the common stock for twenty-one years without interruption, and both the preferred and common stocks, which have a par value of $25, now receive dividends at the rate of 8 per cent. The mortgage bonds of the Philadelphia Electric Company aggregate $80,239,700, including the new bonds. Behind these bonds comes $65,049,250 in par value of common and preferred stocks, which at present market quotations have a value of nearly $99,000,000.

**Elmira Company Increases Capitalization.**—A certificate has been filed in the office of the Secretary of State at Albany, through Stanchfield, Collin, Lovell & Sayles, attorneys, Elmira, N. Y., increasing the capital stock of the Elmira Water, Light & Railroad Company from $5,200,000 to $6,200,000.

**Bonds Called for Payment in December.** — Among the electric light and power bonds called for payment in December in advance of maturity are the following: Public Service Corporation of New Jersey 7's, amounting to $9,600,000 and maturing in 1941 at 107½; Brooklyn Edison Company 7's, series D, amounting to $8,000,000 and maturing in 1940 at 107½; Southern Minnesota Gas & Electric 6½'s, maturing in 1942 and amounting to $1,275,000 at 107½; Federal Power & Light 8's, amounting to $499,000 and maturing in 1925 at 101, and the Catawba Power 6's, amounting to $17,500 and maturing in 1933 at 105.

**Winnipeg Electric Declares First Dividend in Eight Years.**—Directors of the Winnipeg Electric Company have declared a dividend of 1 per cent on the $11,000,000 common stock, payable February 1 to stockholders of record January 15. For the past eight years no dividends have been declared.

**Dallas Company Increases Capital.**—The stockholders of the Dallas Power & Light Company voted recently to increase the authorized capital stock from $4,500,000, consisting of $2,500,000 preferred and $2,000,000 common, to $6,000,000, consisting of $3,500,000 preferred and $2,500,000 common. Of the new preferred $500,000 will be placed locally. The common stock holders will be given the right to subscribe to the new $500,000 common stock pro rata.

**Jersey Public Service Increases Preferred Stock to $100,000,000.**—The Public Service Electric & Gas Company of New Jersey has filed with the Secretary of State at Trenton an amended certificate of incorporation increasing its preferred stock from $30,000,000 to $100,000,000, consisting of $20,000,000 of 7 per cent cumulative preferred, $10,000,000 of 6½ per cent cumulative preferred and $70,000,000 of 6 per cent cumulative preferred. Up to the present time the Public Service Electric & Gas Company had only one class of preferred stock.

**Listings.**—The New York Stock Exchange has authorized the listing of the following: Cumulative 7 per cent preferred stock, series A, of the Columbia Gas & Electric Company amounting to $14,260,300 and preferred stock to the amount of $739,700 on official notice of issuance, making a total of $15,000,000; additional first and refunding mortgage 5 per cent sinking-fund gold bonds, series A, of the Montana Power Company totaling $500,000; additional 7 per cent cumulative preferred stock of the Niagara, Lockport & Ontario Power Company amounting to $1,000,000 on official notice of issuance and payment in full.

**Texas Company Increases Capital Stock.**—An amendment to the charter of the Houston Lighting & Power Company has been filed in the Secretary of State's office at Austin, increasing the capital stock from $4,500,000 to $6,000,000. According to S. R. Bertron, Jr., vice-president and general manager of the company, the increase in capitalization is being made to care for the expansion program undertaken on the ship channel, where the first unit of a ten-million-dollar plant has been completed. The $1,500,000 increase includes $1,000,000 in preferred and $500,000 in common stock. All the latter and half of the former have been sold, according to Mr. Bertron, who stated that the remaining $500,000 of preferred stock will be disposed of when the money is needed.

## Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the past week:

| Name of Company | Per Cent | When Payable |
|---|---|---|
| Adirondack Pwr. & Lt., 7% cum., pf | 1¾ | Jan. 1 |
| Adirondack Pwr. & Lt., 8% cum., pf. | 2 | Jan. 1 |
| Alabama Power, pf. | $1.75 | Jan. 1 |
| Arkansas Central Power, pf. | $1.75 | Jan. 2 |
| Arkansas Light & Power, pf. | 1¾ | Jan 1 |
| Binghamton Lt., Ht. & Pwr., com. | 2½ | Jan. 2 |
| Binghamton Lt., Ht. & Pwr, 6% pf. | 1½ | Jan. 2 |
| Binghamton Lt., Ht. & Pwr., 7% pf. | 1¾ | Jan. 2 |
| Dominion Power & Transmission, pf. | 1¾ | Jan. 15 |
| El Paso Electric, pf. A | 1¾ | Jan. 15 |
| El Paso Electric, pf. B | 1½ | Jan. 15 |
| Florida Public Service, pf. | 1¾ | Jan. 2 |
| Greenfield Electric Lt. & Pwr., com. | 2 | Dec. 31 |
| Greenfield Electric Lt. & Power, *. | 20c | Dec. 31 |
| Greenfield Electric Lt. & Power, pf. | 38c | Dec. 31 |
| Jersey Central Power & Light, 7% pf. | $1.75 | Jan. 1 |
| Kansas Gas & Electric, pf. | 1¾ | Jan. 2 |
| Massachusetts Lighting, com. | 75c | Dec. 30 |
| Massachusetts Lighting, 6% pf. | $1.50 | Jan. 15 |
| Massachusetts Lighting, 8% pf. | $2 | Jan. 15 |
| Middle West Utilities, pf. | $1.75 | Jan. 15 |
| Mohawk Valley, extra | $4 | Jan. 2 |
| Mohawk Valley | $2 | Jan. 2 |
| New Orleans Public Service, Inc., pf | 1¾ | Jan. 2 |
| Newport News & Hampton Railway, Gas & Electric, pf. | 1¾ | Jan. 1 |
| Northern Indiana Gas & Elec, A pf. | 1¾ | Jan. 14 |
| Ohio River Edison, 7% pf. | 1¾ | Jan. 2 |
| Pacific Gas & Electric | $2 | Jan. 15 |
| Puget Sound Power & Light, com. | $1 | Jan. 15 |
| Puget Sound Power & Light, 6% pf. | $1.50 | Jan. 15 |
| Puget Sound Power & Light, pr. pf. | $1.75 | Jan. 15 |
| Quebec Power, Ltd. | 4 | Jan. 15 |
| Rutland Railway Light & Power, pf. | 1¾ | Jan. 2 |
| Sayre Electric, pf. | 1¾ | Jan. 2 |
| Shawinigan Water & Power | 1¾ | Jan. 10 |
| Southeastern Power & Light | $1.75 | Jan. 15 |
| Southern Canada Power, pf. | 1½ | Jan. 15 |
| Turners Falls Power & Electric | 1½ | Dec. 31 |
| Vermont Hydro-Electric, pf. | 1¾ | Jan. 2 |
| Virginia Railway & Power, pf. | 1½ | Jan. 20 |
| West Penn Power, 7% pf. | 1¾ | Feb. 2 |
| Western States Gas & Electric, pf. | 1¾ | Jan. 15 |

* Employees' stock.

**Federal Light & Traction Bonds Non-Convertible.**—The Federal Light & Traction Company recently floated an issue of non-convertible 6 per cent debentures to the amount of $2,500,000. In the December 20 issue of the ELECTRICAL WORLD these bonds were termed "new convertible" in error.

**Long Island Lighting Files Certificate.**—The Long Island Lighting Company has filed a certificate in the office of the Secretary of State at Albany increasing its capital from 200,000 shares of $100 par value to 1,100,000 shares, of which 100,000 shares are preferred $100 par value and 1,000,000 shares are common of no par value.

**Cities Service Company in November.**—Gross earnings of Cities Service Company for the twelve months ended with November 30, 1924, were $17,368,091, as compared with $16,591,577 in the corresponding period of the preceding year. In the same twelve months net earnings amounted to $16,704,044, as compared with $16,074,609. Net to stock and reserves was $14,705,187, which is 2.88 times the preferred stock dividends, as compared with $13,455,688, which was 2.70 times.

**Texas Utility to Finance Expansion with Stock Issue.**—With the purpose of raising funds to finance the recent purchase of the Port Arthur Ice & Refrigerating Company and the Lake Charles Electric Company, the Eastern Texas Electric Company has offered common stockholders as of December 1 the right to subscribe to part of 20,000 shares of common stock on the basis of one new share at $50 for each four held.

*Vol.* 84, *No.* 26 New York, December 27, 1924 *Pages* 1343-1392

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## *In the College Libraries*

PROF. VLADIMIR KARAPETOFF of the College of Engineering, Cornell University, has just written us this:

**"For about a year we have had an electrical library in our engineering school here, and we find that the bound volumes of the ELECTRICAL WORLD are in constant use by our undergraduates. Today our librarian (a tiny girl) complained that her shoulders ache from replacing the bound volumes of the ELECTRICAL WORLD on the shelves. Last week she was away and our stenographer, who took her place, complained of the same thing. The girls suggest that you print a special edition on India paper or discontinue publishing good technical articles that everybody wants to read."**

It is interesting to consider the influence which comes from this close reading of the ELECTRICAL WORLD by the students at the technical colleges. By close study of the news of the electrical industry and the opinions and experience of the leading thinkers in the field as these are set forth in issue after issue, the student becomes familiar with the working world of electricity before he graduates and takes his active part in its affairs. Through a study of the advertising pages of the paper he becomes posted on equipment and materials that later on he will be called upon to use and buy. These readers in the college libraries are potentially a very important and valuable audience.

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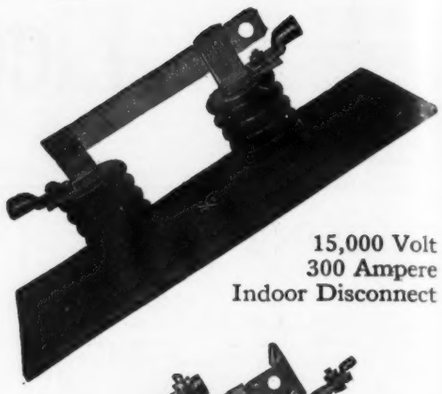
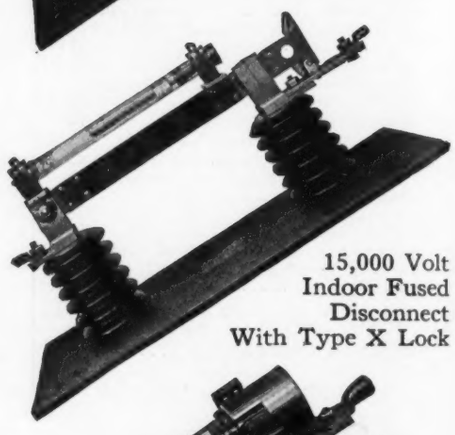
Advertising Index—Alphabetical, 80; Classified, 74, 76, 78; Directory of Engineers, 34, 35; Searchlight Section, 36-43

# S&C Indoor Equipment

The ever increasing demand for **S&C** equipment is proof of its outstanding superiority. Performance is the important factor and **S&C** equipment has won a reputation for constant reliable operation.



15,000 Volt
300 Ampere
Indoor Disconnect



15,000 Volt
Indoor Fused
Disconnect
With Type X Lock

Simplified Designs

Careful Workmanship

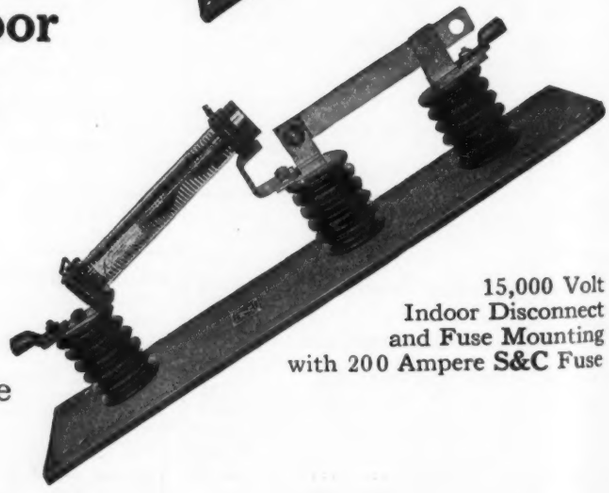
Interchangeability of All Parts

Best Grade of Materials Used Throughout

15,000 Volt
400 Ampere
**S&C** Fuse and
Indoor Mounting

## A Complete Line of Indoor High Voltage Equipment

**Described in Bulletin 222**



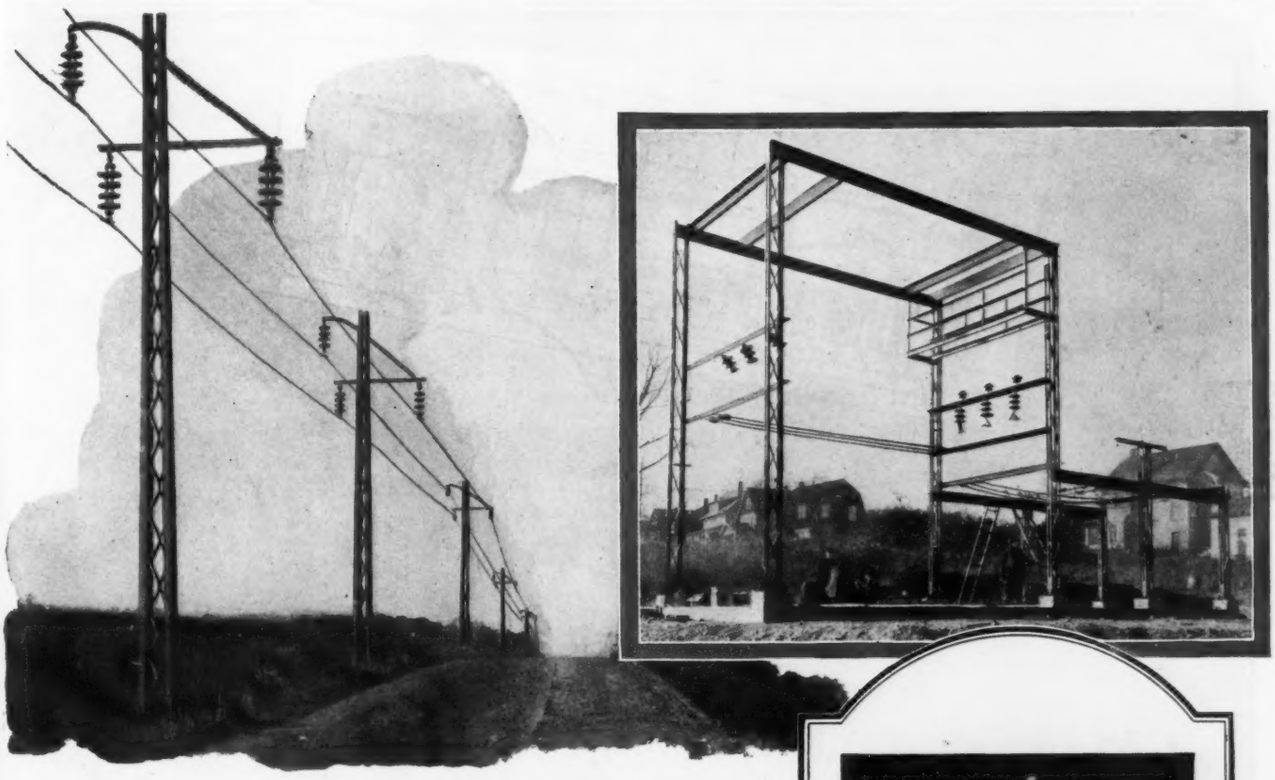
15,000 Volt
Indoor Disconnect
and Fuse Mounting
with 200 Ampere **S&C** Fuse

*Of Course!*

There is No Substitute for the **S&C** Fuse

**SCHWEITZER S&C CONRAD, INC.**

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS U.S.A.



# Symmetry—Strength And Economy

The ugly, irregular rows of wooden poles are disappearing from our highways. In their place symmetrical lines of graceful, indestructible steel have come to guarantee dependability in transmission of message and power.

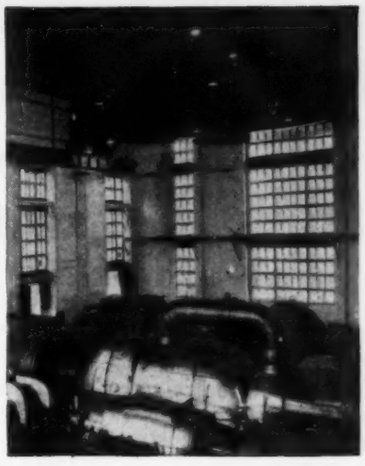
Truscon Copper Bearing Steel Poles possess tremendous strength consequent upon their truss formation and will carry longer spans than wooden poles. They cannot break and will only bend when overloaded. The savings in the number of poles, amount of equipment and installation labor is very great. Depreciation is almost negligible.

Truscon Copper Bearing Steel Double Poles meet the requirement where unusual strength is necessary. The initial cost of Truscon Steel Poles is no greater than for A-1 wooden poles. Made in all sizes and lengths of a standard design also furnished in any special design or size as specified.

Send the coupon for special information and prices.

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO

*Warehouses and Sales Offices from Pacific to Atlantic.*
*For addresses see phone books of principal cities*
*Canada: Walkerville, Ont. Foreign Div.: New York*



**Truscon Steel Windows conform to every demand of fireproofness, light and ventilation in power house construction. The types include Standard Pivoted, Sidewall, Projected and Top Hung Continuous with mechanical operators and steel frames.**

# TRUSCON STANDARD STEEL POLES

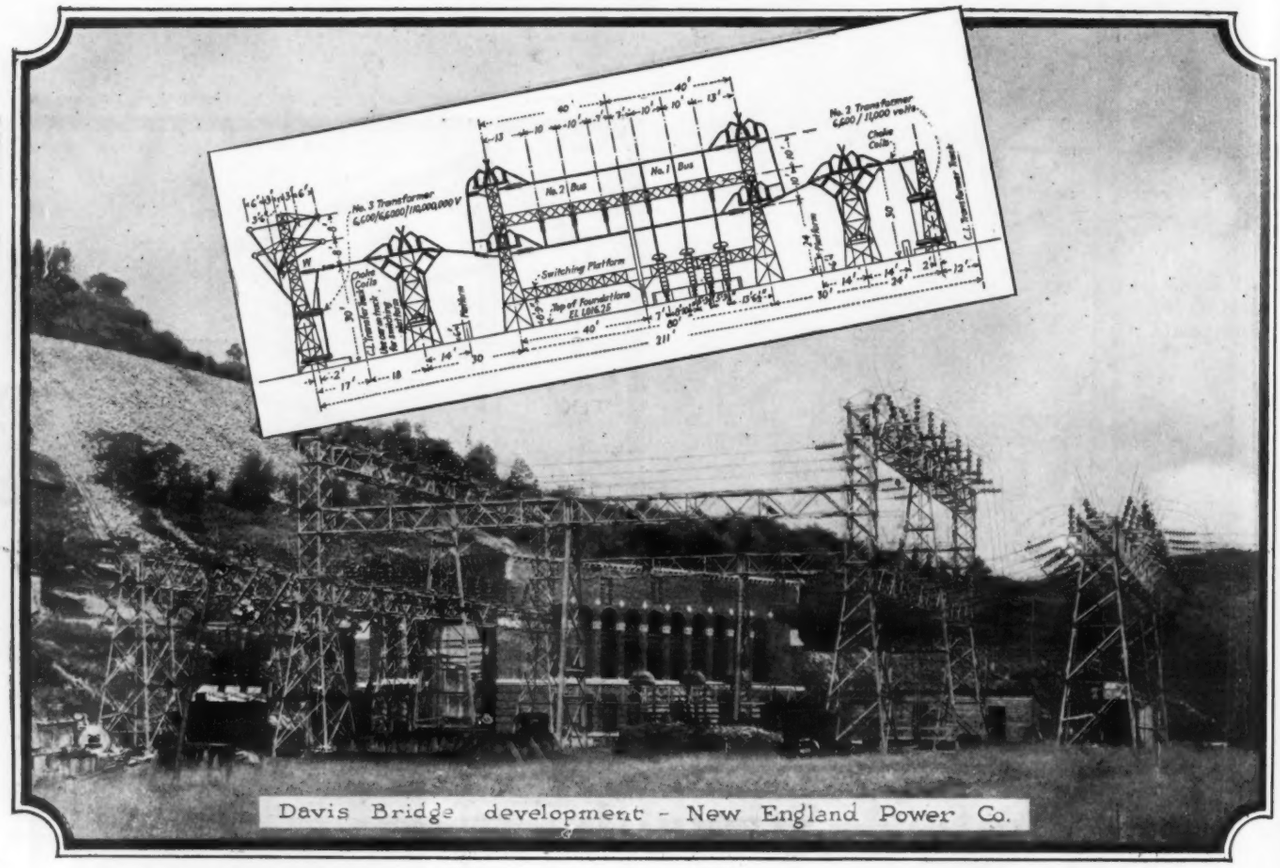
**Truscon Steel Company, Youngstown, Ohio**

Please send me your booklet "Truscon Steel Poles."

Name .....

Address .....

E.W. 12-27-24




# 110,000-volt station with ELPECO Switching Equipment...

This shows the 110,000-volt Davis Bridge Station—one of nine that will ultimately be constructed to develop 110,000-kva. along the Deerfield River by the New England Power Co.

This installation is rated at 32,000-kva. Its most important features are: a high voltage trunk line to the load center of system and flexible double switching yards.

In keeping with policy of the New England Power Co., the very latest designs of equipment available have been included in this layout.

There are two complete outdoor double-bus galvanized-steel switching stations, one for 66,000 volts and one for 110.000 volts. All transformers and oil switches are provided with Elpeco Bus Selector switches and also Elpeco Air Break switches, so that any oil switch may be taken out of service at any time for inspection.

For full details on this and other up-to-date installations of Elpeco equipment, just address the Company.

Electrical Engineering & Mfg. Co.,
907 Penn Avenue,
Pittsburgh, Pa.

Electrical Engineering & Mfg. Co.,
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Cleveland, Ohio

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# ON JANUARY FIRST—

The Locke Insulator Corporation announces that, beginning the new year, the General Sales Department, in charge of Mr. B. A. Plimpton, General Sales Manager, and the Engineering Department, in charge of Mr. K. A. Hawley, Chief Engineer, will be located in the executive offices of the Company—

The Maryland Trust Building
Baltimore, Md.

It is also announced that the following District Offices have been established to take over the territories formerly covered by agents:

Chicago, Illinois
766 Illinois Merchants Bank Bldg.
A. M. Jackson, Dist. Sales Mgr.

Philadelphia, Pennsylvania
803 Atlantic Bldg.
J. G. Dellert, Dist. Sales Mgr.

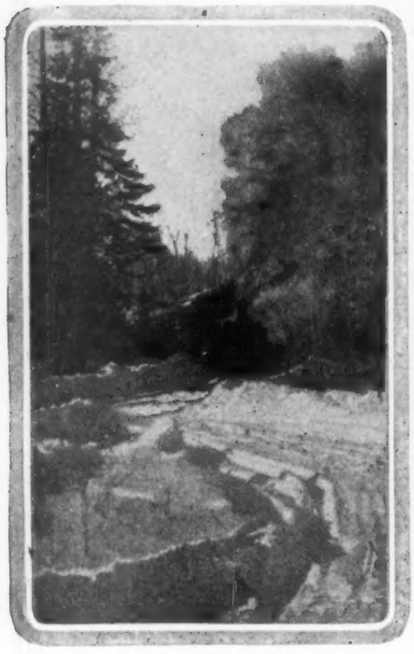
Victor, New York
Locke Insulator Bldg.
A. G. Bernard, Dist. Sales Mgr.

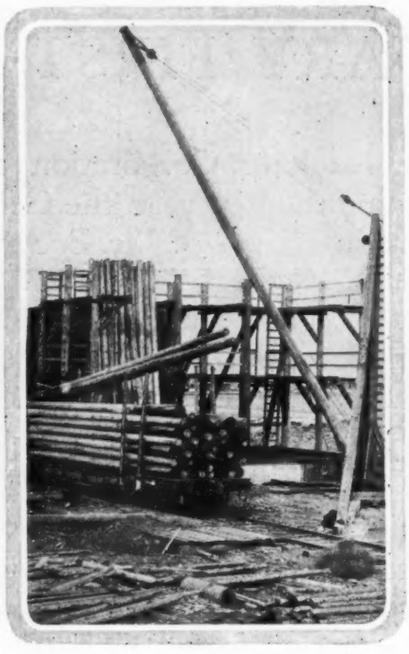
The Locke Insulator Corporation
Baltimore, Md.
Factories: Victor, N. Y., and Baltimore, Md.

LOCKE
PORCELAIN

NPCo

**Western Red Cedar** — **Plain or Treated Poles** — **Northern White Cedar**





# *From the forest—to the tanks—to the line*

You couldn't beat that famous old combination, "Tinker to Evers to Chance" any more than you can beat the service which the National Pole Company has developed in its forty-five years of activity.

NATIONAL 1924 POLE CO.

From our own vast holdings all the way to the line (via one of our four large treating plants) there is a never-ending stream of Western Red and Northern White Cedar poles moving in all directions to keep the pole buyers of America supplied with the finest poles that grow.

NPCo

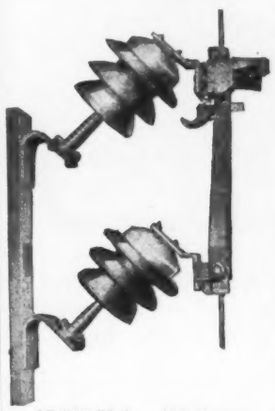
# NATIONAL POLE COMPANY

**Escanaba, Michigan**

*Distributors:*
*Western Electric Company*

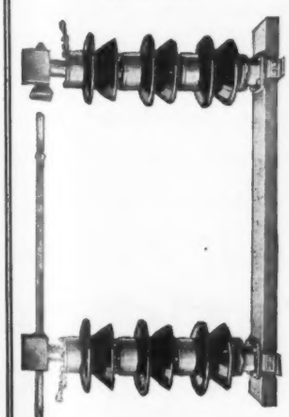
# R.&I.E.Co.
## DISCONNECTS

Group Assembly of Parts



37,000 Volt—600 Amp.
Vertically Mounted
Disconnecting Switch
Type DV-2

37,000 Volt—300 Amp.
Inverted Disconnecting Switch
Type DI-2



88,000 Volt Plunger
Switch Partially Open

*"We Must Buy Reliable Disconnects, Zach,*

—it seems to me that many engineers, who go the limit to get oil switches with high rupturing capacity, overlook the fact that the disconnects must carry the same short circuit current."

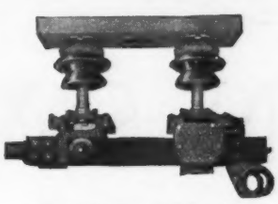
"I haven't, Chief. These R. & I. E. designs are carefully thought out. There is a straight thru path; the high pressure full floating self aligning jaw contacts are backed up by heavy springs which carry no current; trussed blades only are used and they have positive locks with a pryout lever."

"That's good, we want no switches which require careful alignment of blades or 'grinding in' of contacts. Replacement of parts is too expensive."

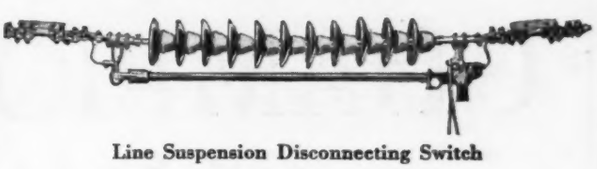
"We have had only one replacement on R. & I. E. switches, Chief, and that was when Jim dropped a wrench. The new unit we ordered was a *perfect* fit and the *easiest* replacement we ever made. Their machining and assembly is absolutely accurate."

*Bulletin No. 1310 shows more distinctive features of R. & I. E. designs.*

RAILWAY AND INDUSTRIAL ENGINEERING COMPANY
GREENSBURG, PA.
TRANSMISSION SWITCHING AND PROTECTIVE — EQUIPMENT —
RAILWAY AND INDUSTRIAL ENGINEERING CO.
DISTRICT OFFICES
PITTSBURGH NEW YORK
BOSTON CHICAGO
CINCINNATI PHILADELPHIA
CLEVELAND INDIANAPOLIS



1600 Amp.—Type DI-2
Disconnecting Switch



Line Suspension Disconnecting Switch

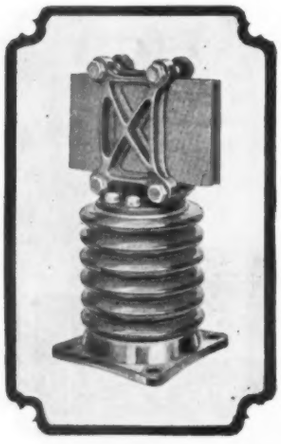
# Champion Signifies Dependability

COMPLETE interchangeability is one of many outstanding advantages found in Champion Indoor Bus Supports. It helps materially to avoid long interruptions of service. It also reduces costs, because the maintenance of excessive stock is no longer necessary.

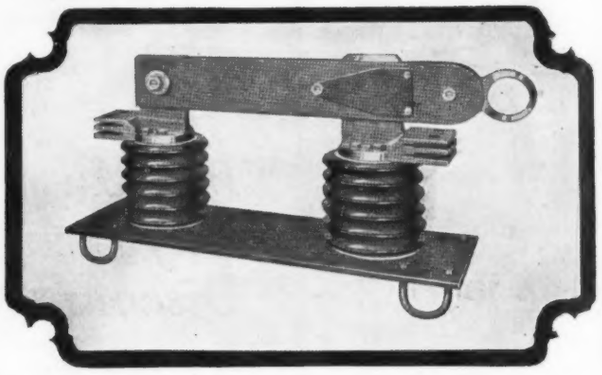
Due to Champion's simplified construction, a comparatively small stock is all that is needed to meet any emergency—a few porcelains, various sizes of bar, cable or tube clamps and style bases. Power engineers will find these sufficient to assemble any combination on quick notice for changes or minor extensions.

The interchangeable feature of the insulators, particularly, is an advantage that has been quickly recognized.

If by reason of any abnormal conditions the porcelains become damaged they can be easily removed and replaced. This is quickly accomplished by means of machine bolts which form a permanent gripping assembly with the aid of brass bushings embeded in corrugated holes of the insulators. Thus there are no cemented joints to crack or crumble under vibration or mechanical impact.



Additional Champion service can be had in all types of outdoor equipment, choke coils, etc.,—all of the most modern type and offering strong, substantial designs. Write for Bulletin B and prices.



CHAMPION Indoor Disconnecting Switches embody new features of design and an exceptionally high quality of materials and workmanship.

Power engineers are finding these characteristics well worth careful study because they assure greater dependability and a higher degree of economy of maintenance than is commonly available.

The insulators are built exclusively of solid one-piece porcelain by the casting process of the J-D Insulator Company and are completely interchangeable for all types of bus supports and switches.

A highly valuable feature is the one-piece, drop-forged, pure copper hinge and contact clips, generously proportioned. A self-adjusting blade maintains uniform pressure on the contact surfaces without chafing the copper of the blade on the corners of the clip. All danger of imperfect contact is eliminated.

The complete Champion organization is always at your service and ready to help solve your special switching problems. Write for Bulletin C and prices.

THE CHAMPION SWITCH COMPANY—550 ABBOTT ROAD—Post Office Box 816—Buffalo, N. Y.

SALES REPRESENTATIVES

Garland Affolter Engineering Company
Rialto Building San Francisco, California

Garland Affolter Engineering Company
I. W. Hellman Building Los Angeles, California

Garland Affolter Engineering Company
Alaska Building Seattle, Washington

Champion Switch Company
Rooms 510-512 2 Rector St. New York City

A. H. Savage & Company
914 Pioneer Building St. Paul, Minnesota

T. W. McKay
Manitoba Power Co., Ltd., Winnipeg, Can.

Ralph D. Ernest
205 Kresge Building Detroit, Michigan

Champion Switch Company
412-413 Glenn Building Atlanta, Georgia

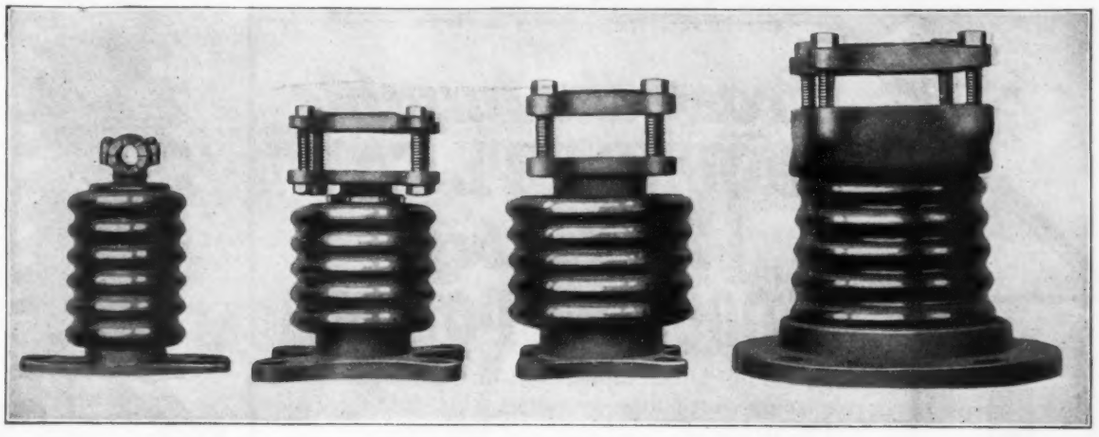
Champion Switch Company
924 Marquette Building Chicago, Illinois

# The CHAMPION SWITCH COMPANY

THE STANDARD OF COMPARISON

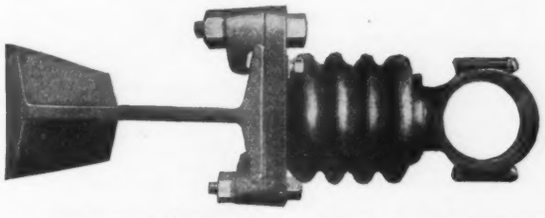
# The Delta Star

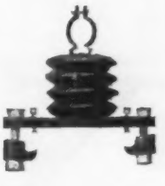
UNIT TYPE



## Constantly Improved— But Standards Maintained

By establishing and maintaining standards Delta-Star takes from the shoulders of the operating man the burden of expense which always occurs when equipment becomes obsolete or does not match up with new equipment. Unit Type parts shipped in 1914 interchange with those shipped in 1924.



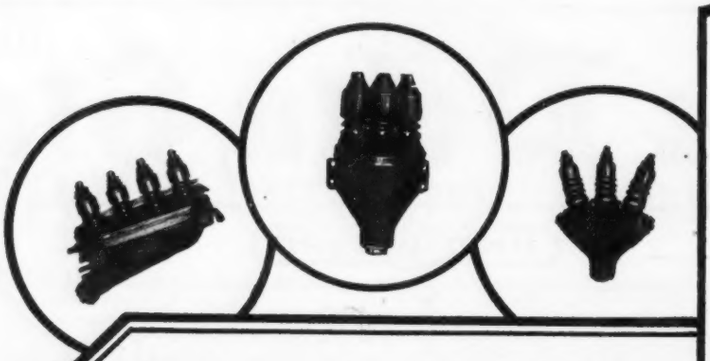


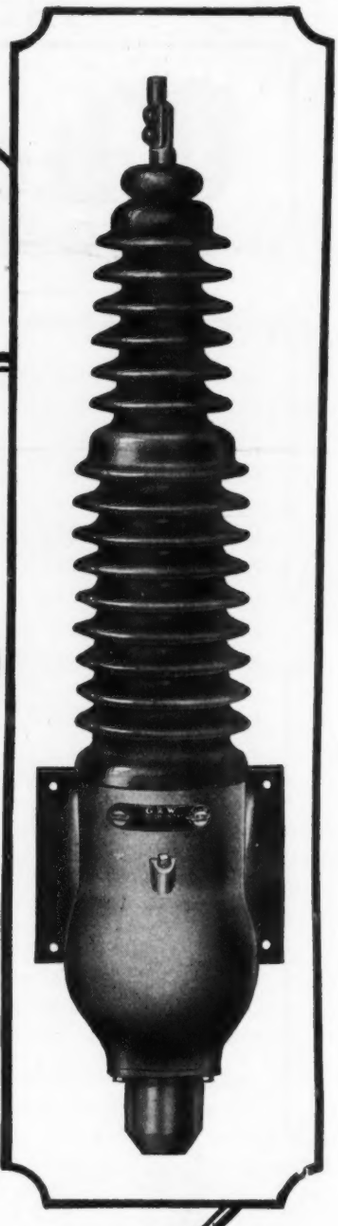
YOU CANNOT EASILY SCRAP UNIT TYPE
(IT IS ALWAYS STANDARD)

**DELTA-STAR ELECTRIC CO.**
2400 Block Fulton St Chicago, Illinois

Albany, N. Y., 715 City Savings Bank Bldg.
Birmingham, Ala., 827-830 Brown-Marx Bldg.
Boston, Mass., 294 Washington St.
Buffalo, N. Y., 595 Ellicott Square
Charleston, W. Va., The Engineering Service Co.
Columbus, Ohio, 600 Joyce Realty Bldg.
Detroit, Mich., 708 Ford Bldg.
Indianapolis, 518 Trac. Term. Bldg.
Kansas City, Mo., 301-2 Dwight Bldg.
Knoxville, Tenn., Holston Nat'l Bk. Bldg.
Los Angeles, Calif., I. W. Hellman Bldg.
Minneapolis, Minn., 940 Security Bldg.
New York, N. Y., 25 Broad St.
Orlando, Fla., Cornell-Mathews Co.
Philadelphia, Pa., 1333 Real Estate Trust
Pittsburgh, Pa., 934 Union Trust Bldg.
Rochester, N. Y., 119 Main St., E.
Salt Lake, Utah, 313 Dooly Bldg.
San Francisco, Calif., 193 Second St.
Seattle, Wash., Hoge Bldg.
St. Louis, Railway Exchange
Syracuse, N. Y., City Bank Bldg.
Toronto, Ont., 213-219 Sterling Rd.
Berthon & Touzot, 40 Rue d'Aguisseau, Boulogne-sur-Seine, France
Carrick, Wedderspoon, Ltd., Christchurch, New Zealand
A/S Kraftoverforing, Kristiania, Norway
Allenwest, S. A., Ltd., City House Johannesburg, So. Africa
Allied Engineering Ltd., Sydney, Australia

UNIT TYPE CEMENTED SWITCH INSULATORS





# *From the humble* GROUND PIPE CAP *To the big* 66,000 VOLT POTHEAD

Ground Pipe Driving Point

Cap

Get the full benefit of our years of experience in designing distribution specialties.

G & W designs and ideas have kept pace with modern distribution methods. They have consistently led the field.

Roominess or compactness, low voltage or high voltage, heavy currents or series circuits, disconnecting or non-disconnecting—whatever your requirements, they are available in G & W designs.

From the smallest specialty to the largest box or pothead, every G & W product is a development of G & W experts. Let us show you how G & W Potheads and Boxes will make *your* system more flexible.

**G & W Electric Specialty Co.**

*Manufacturers of Potheads, Disconnecting and Non-disconnecting; Switching and Distribution Boxes; Overhead and Underground Distribution Specialties*

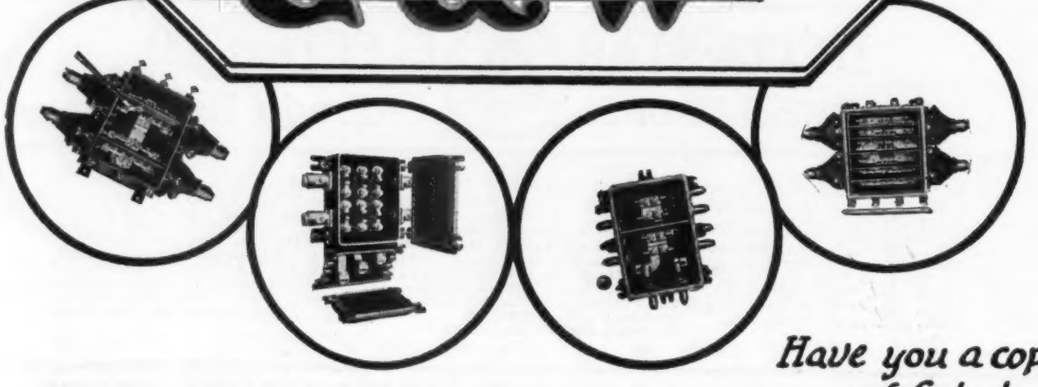
**7430-52 So. Chicago Ave., Chicago, Ill.**

SALES REPRESENTATIVES IN THE LARGER CITIES

G & W

POTHEADS AND BOXES

MANUFACTURERS OF DISTRIBUTION SPECIALTIES



*Have you a copy of Catalog 12?*

# Moloney Transformers

## The Seasons Greetings

To the whole industry we send the Season's Greetings. We wish you to feel that only as the whole industry progresses can the individual companies and individuals progress. To this progress the Moloney Electric Co., has contributed its full share.

At this time of the year, we like to think of those who have accepted and who have been benefited by the original Moloney thinking of twenty-eight years ago.

Many of our present customers remember that the Moloney Electric Co., was one of the first to employ silicon steel in transformers, also that this company was the first to build successfully the three wire core-type transformer.

We are glad to continue to be of service to those who have purchased Moloney transformers in the past. And to those who have not yet given Moloney transformers a trial, we point to the industry's appreciation of our products—reflected by the growth of our facilities from one to five factories. The Moloney Organization, therefore, wishes to thank you and to extend its wishes for a very prosperous New Year.

**Moloney Electric Co.**
St. Louis, Mo.

## *Looking into the New Year*

As we look forward into 1925, there is every probability that it will be the greatest electrical year which we have ever seen.

Service in securing electrical equipment will, next to Quality, be of paramount importance. We interpret service to mean, "getting what you want, when you want it."

It will be well worth your while to look into the matter of Packard Quality and Packard Service now.

*The Packard Electric Company*
**Warren, Ohio**

*Packard* **is never seen, except on goods of honest value.**

# EUTECTIC

## A Word Meaning
## BALANCED MIXTURE

For insulators, the point at which, considering strength Mechanical and Electrical, whiteness, plasticity, etc., clay, flint and feldspar give the best working and firing results to combine the highest possible characteristics desirable in finished Porcelain for Electrical Insulating purposes.

Special study given to your Insulating Problem.

## Franklin Porcelain Co.

**Norristown, Pa.**

# Porcelain Pin-Type Insulators

No. 104, Trade Voltage Rating 4400.

No. 114, Trade Voltage Rating 4400.

No. 146, Trade Voltage Rating 7500.

No. 136, Trade Voltage Rating 6600.

No. 1111, Trade Voltage Rating 13,500.

## Always

## A Complete Stock In Our Warehouses

ready for immediate shipment.

These district warehouses are conveniently located from coast to coast, as listed below:

| | | | |
|---|---|---|---|
| **Atlanta** | — 426 Marietta St. | **Huntington** | — 2nd Ave. & Ninth St. |
| **Baltimore** | — 121 E. Baltimore St. | **Indianapolis** | — 814-820 N. Senate Ave. |
| **Boston** | — 12 Farnsworth St. | **Jacksonville** | — Union & Ionia Sts. |
| **Buffalo** | — 145 Milton St. | **Kansas City** | — 1214-16 West 19th St. |
| **Butte** | — Block 742 Bryant Ave. | **Los Angeles** | — 420 S. San Pedro St. |
| **Charlotte** | — North Ave. & East 7th St. | **Minneapolis** | — 2303 Kennedy St., N. E. |
| **Chicago** | — 2211 W. Pershing Road | **New Orleans** | — 1028 S. Rampart St. |
| **Cincinnati** | — Third & Elm Sts. | **New York** | — Bush Terminal Bldg. |
| **Cleveland** | — 2209 Ashland Road, S. E. | **Philadelphia** | — 30th & Walnut Sts. |
| **Columbus** | — 181 South LaSalle St. | **Pittsburgh** | — Liberty Ave. & 29th St. |
| **Dallas** | — 703 Elm St. | **St. Louis** | — 12th & Gratiot Sts. |
| **Denver** | — 1909-13 Blake St. | **Salt Lake City** | — 573 West 2nd South St. |
| **Detroit** | — 1535 Sixth St. | **San Francisco** | — 1400 Fourth St. |
| **El Paso** | — 511 North Ochoa St. | **Seattle** | — 3451 E. Marginal Way |
| **Houston** | — 1510 Congress Ave. | | |

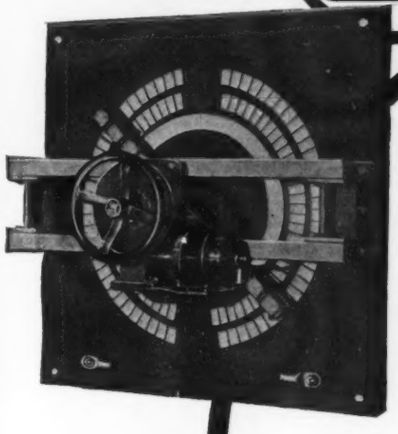
The nearest warehouse will give your orders prompt attention.

Westinghouse Electric & Manufacturing Company
Agent for Westinghouse High-Voltage Insulator Co
General Office: Derry, Pa.
Works: Derry, Pa., Emeryville, Calif.

# Westinghouse

# A GENERATOR VOLTAGE REGULATOR

*Better than man*



AN automatic generator voltage regulator controlling a high speed motor-operated generator field rheostat better than it could be controlled by hand.

The rheostat is operated at high speed until the voltage is within ten percent of normal and then the remaining ten percent is changed slowly until the line voltage is normal. This method prevents hunting, an inherent weakness of previous generator voltage regulators of this type.

The regulator operates directly from the line and therefore does not affect the exciter voltage. This characteristic allows the exciter to be used for lighting and other purposes where the voltage must be kept constant.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of
the United States and Foreign Countries

**Westinghouse**

X 78414

# FIRST TO USE

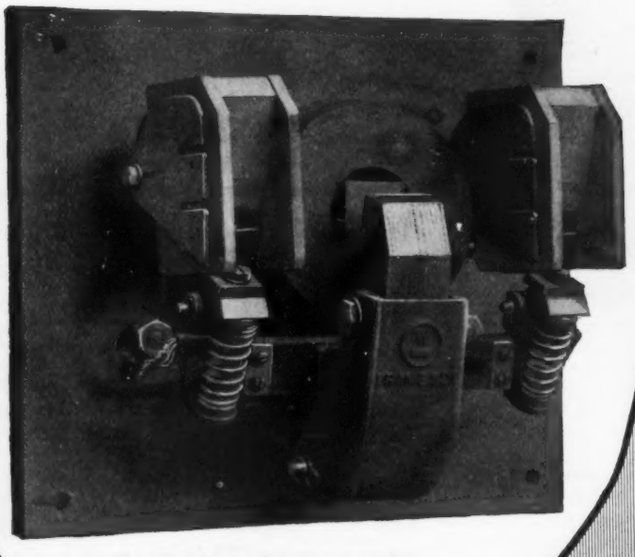
*self-aligning armatures with double shading coils*

SEVEN years ago, self-aligning armatures with double shading coils were introduced on Westinghouse a-c. controller contactors.

As a result, noise, vibration, and wear were reduced to a minimum; armature life was appreciably increased; satisfactory contactor operation was assured; and special fitting of parts was no longer required.

Today, industry recognizes the Westinghouse a-c. self-aligning armature with double reducing coils as the most satisfactory design on the market. It is another standard part of all Westinghouse a-c contactors materially contributing to the better operation of modern electrical equipment.

Westinghouse Electric & Manufacturing Company
East Pittsburgh Pennsylvania
Sales Offices in All Principal Cities of
the United States and Foreign Countries



The Westinghouse a-c. contactor with self-aligning armature and double shading coils

W
WESTINGHOUSE ELECTRIC

Westinghouse

X 78434

# Answer to Cross Word Puzzle

***Published in Dec. 20 Issue of Electrical World***

"*Get in touch with Condit*"

**CONDIT ELECTRICAL MFG. CO.**

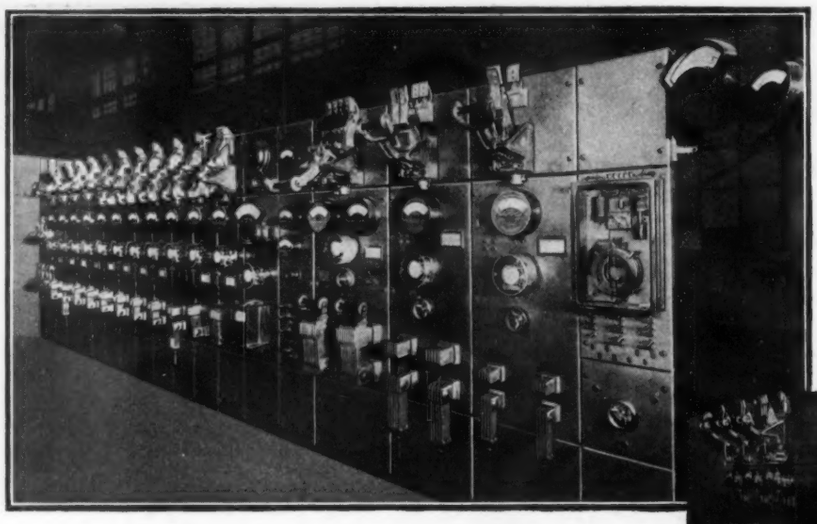
*Manufacturers of Electrical Protective Devices*

**South Boston, Mass.**

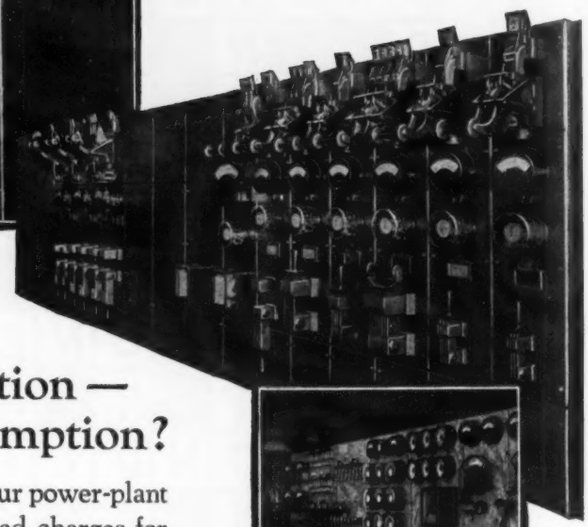
*Northern Electric Company*
LIMITED

**Sole Distributors for the Dominion of Canada**

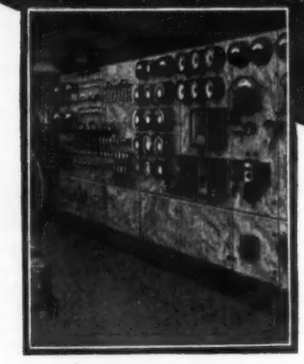
CONDIT



Switchboard, Superior Steel Corporation, Carnegie, Pa., equipped with Sangamo Direct-current D-5 Meters.



Switchboard, A. M. Byers Company, Pittsburgh, Pa., equipped with Sangamo D-5 Direct-current Meters.



Switchboard, Cleveland Twist Drill Company, Cleveland, Ohio, equipped with Sangamo Type H Alternating-current Meters.

# You *economize* in power production — are you *wasting* in power consumption?

IS it good business or good common sense to hound your power-plant engineer to save money on operating costs and fixed charges for power *production* — yet remain in ignorance of whether or not that power is economically *used*?

You install automatic coal scales — steam-flow meters — $CO_2$ recorders — to check the efficiency of your steam-making equipment.

But what do you know about the power consumption in your business departments — of your machines — your processes?

How can you expect your accounting department to know what proportion of your total power costs to charge against those departments — those processes — unless you install suitable instruments to record power consumption?

Many industrial executives today are making big savings on power costs by accurately checking electric-power distribution through the installation of Sangamo Watthour Meters on the main feeders supplying power to each department or power-consuming process.

These business men *know* where the power goes — when it is wasted — and *where*. They know COSTS.

Sangamo engineers will gladly cooperate with your own engineers for the installation of similar equipment in your plant.

Write for special data and bulletins.

SANGAMO

SANGAMO ELECTRIC COMPANY
Springfield, Illinois

NEW YORK CHICAGO BIRMINGHAM SAN FRANCISCO LOS ANGELES

6920-3

# SANGAMO METERS

FOR EVERY ELECTRICAL NEED

# USED—

by reputable electrical heater manufacturers—industrial and household:

# SPECIFIED—

by electric-heating engineers, and by leading jobbers and dealers:

# EXPECTED—

by experienced users who are accustomed to dependable performance:

"Nichrome" the standard of comparison in electric heating element performance, is the resistance wire, ribbon and strip made by the DRIVER-HARRIS Co., Harrison, N. J. and Manchester, England.

U. S. Branch Offices: Chicago and Detroit.

Pacific Coast Distributors: John A. Roeblings Sons Co. of Calif. San Francisco, Los Angeles, Portland, Seattle

*For the Higher Temperatures, "Nichrome" IV*

TRADE MARK REG. U.S. PAT. OFF.

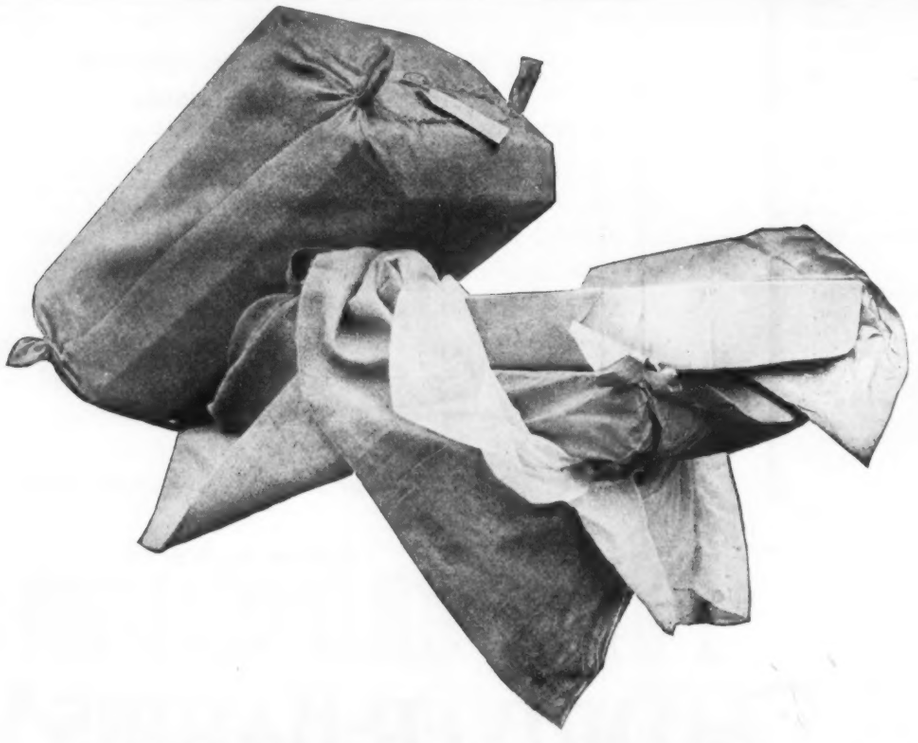
# Nichrome

## The DRIVER-HARRIS WIRE

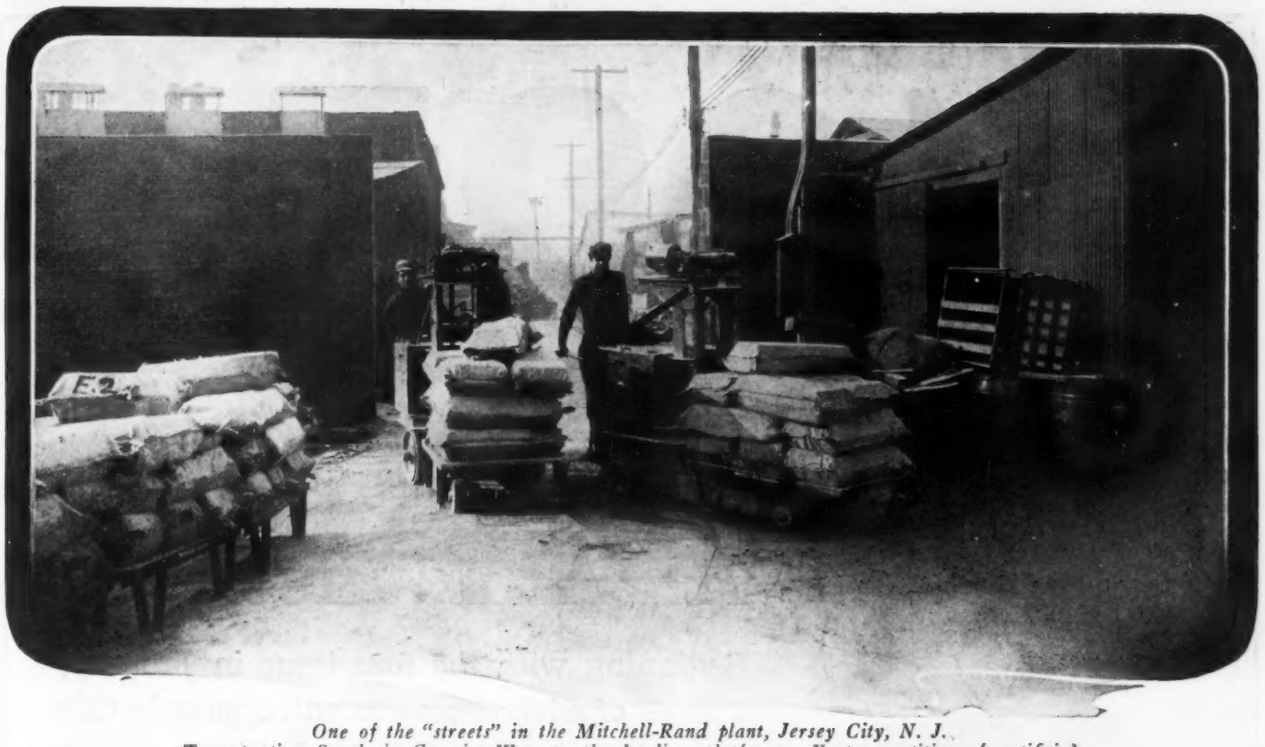
# WE WORK WITH WAXES

*Everything in Insulation*

## MITCHELL-RAND



MITCHELL-RAND MFG. CO.,



*One of the "streets" in the Mitchell-Rand plant, Jersey City, N. J. Transporting Synthetic Ceresin Wax to the loading platform. Vast quantities of artificial ceresin are used in the manufacture of pharmaceutical creams, polishes, etc.*

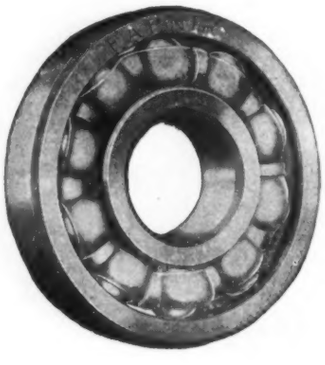
# MAKES MANY MIXTURES

Animal, Vegetable and Mineral Waxes—gathered from China, Japan, India, Galicia, Saxony, Mexico, Brazil and the Americas—are employed in the manufacture of our insulating and commercial compounds.

**17 VESEY ST., NEW YORK, N. Y.**

# 1925

BALL BEARINGS
FOR
ELECTRIC MOTORS



## An Announcement

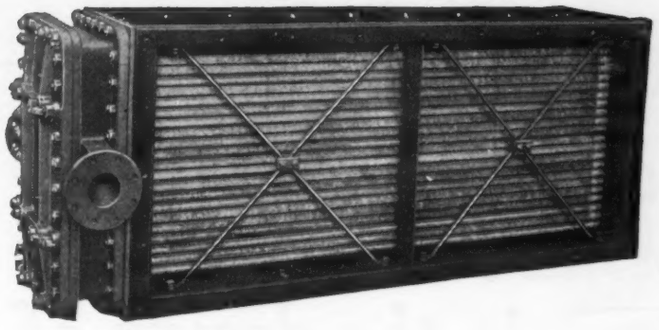
Beginning with the first issue in January, a series of advertisements will appear in this magazine over the name of this company dealing with the advantages and applications of ball bearings for electric motors. The series will continue thruout the year in the first issue of each month.

Each time one point of design or service will be brought up, explained and illustrated. The entire series will thus offer what should be of especial interest at this time—a connected summary of the case for ball bearing motors.

THE FAFNIR BEARING COMPANY
Detroit *New Britain, Conn.* Chicago

FAFNIR
BALL BEARINGS

# Do your generators keep cool?



# The U-fin Generator Air Cooler

1—keeps the generator windings cool,

2—recovers the heat loss by using it to heat the turbine condensate on the way to the boilers,

3—keeps the generator windings free from dust,

4—reduces fire risk,

5—provides humidity control of the air to the generator windings.

**Send coupon for bulletin describing the air cooler that is serving OVER 1,000,000 K.W.**

REG. U.S. PAT. OFF.

**The Griscom-Russell Company**
**2119 West Street Bldg., New York**

Philadelphia
Boston
Rochester
Pittsburgh
Columbus

Chicago
Detroit
Cleveland
Indianapolis
Milwaukee
Minneapolis

St. Louis
Kansas City
New Orleans
Charlotte
Houston
Dallas

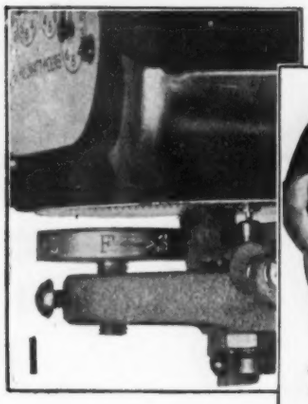
San Francisco
Los Angeles
Seattle
Salt Lake City
Denver

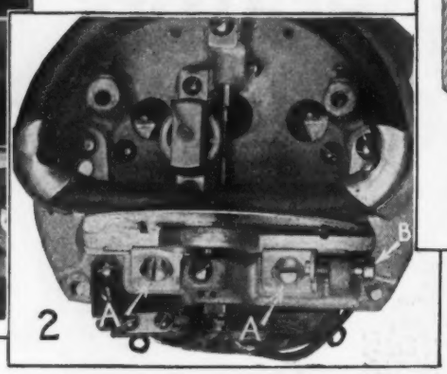
For Canada: **Riley Engineering Co., Ltd., Toronto**

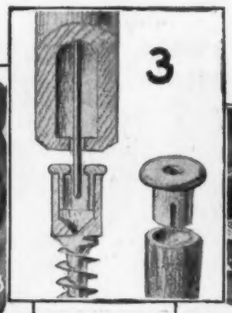
Name.....
Company.....
Address.....

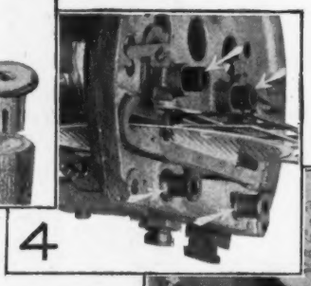
The Griscom-Russell Co.,
2119 West Street Bldg., New York
Send me at once, without charge a copy of your Bulletin No. 1216 describing the U-fin Generator Air Cooler.

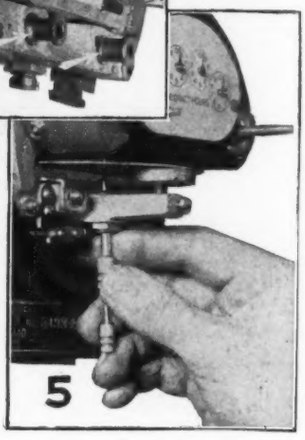
E. W. 12-27-24



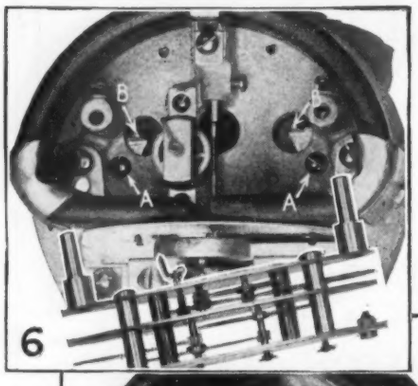



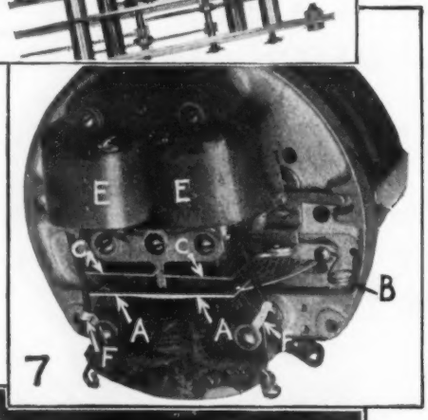



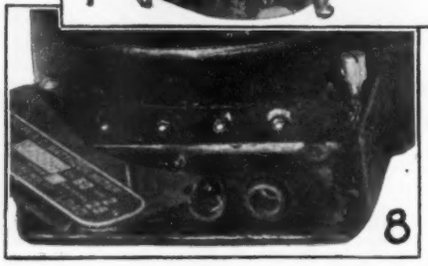




# *How the convenience of the Meter Man has been considered in the design of Duncan Meters*




**To demonstrate in an impressive way the extreme simplicity and ease of caring for the Duncan M 2 watthour meter, a few of the adjustments and maintenance features are illustrated herewith.**

Figure 1 represents the full load adjustment device, a circular block of iron forming a shunt across the poles of the permanent magnet. The air gap is varied by turning the block in the direction indicated by the arrows and the letters F and S. The light load adjustment is shown in Fig. 2, taken from the front of the meter. Clamping screws AA are loosened, then adjusting screw B turned in the proper direction as indicated by arrows and letters F and S stamped on the head. This device is seen from the rear in Fig. 7, which shows, (B) a "back lash" spring, which keeps the sliding plate in positive contact with the adjusting screws, eliminating all lost motion and uncertainty of result. The cleanable, oilless top bearing is shown in Fig. 3. Brass spacing studs which fix the position of the electro-magnets are pressed into the grid (Fig. 4) so they are always in place, greatly simplifying the work of changing coils. The ease of removing and replacing pivots is clearly illustrated in Fig. 5. The phasing or inductive load adjustment is made from the front of the meter, by loosening the clamping screws, AA (Figure 6) and lifting or dropping the ears BB of the adjusting plate, made accessible by holes through the grid. This view also shows the first speed reduction, permanently mounted on the grid, so that no meshing or unmeshing of gears is involved in removing or replacing the register. Part of the meter element from the rear is shown in Figure 7, in which can be seen the light load adjustment plate AA, back lash spring, B, phasing adjustment plate CC, clamping lug D, twin potential coils EE, which cut coil replacement costs to thirty cents, and potential coil lead clip, F, which acts as a lightning arrestor, and saves the coil in 24 out of 25 cases of lightning.

Terminal cover screw, Figure 8, as well as register holding screws, top bearing clamp screw, and current coil lead screws, are only loosened, not removed, when the parts concerned require removal. Time and temper are saved, and work is made more easy, accurate and lasting by Duncan design.

# DUNCAN *Watthour Meters*

**DUNCAN ELECTRIC MANUFACTURING CO., LAFAYETTE, IND.**

*Synchronous Timer*

*Relay Testing Load Box*

# A good combination for testing relays

***The Synchronous Timer*** for relay testing and adjusting is used to measure the actual time delay of a relay setting, or for setting a relay for desired time delay.

The Timer is essentially a Warren Clock synchronous motor which operates the hands of a clock, the hands being started by a friction clutch and stopped automatically as the relay contacts open or close. The time interval is read in cycles from the clock dial. The error introduced is so small as to be inappreciable.

***The Relay Testing Load Box*** is used for regulating the current to the coils of over-current relays, such as the PQ plunger type and the IA induction type. It is provided with resistance units for use in series with a 110-volt lighting circuit, and can be connected to a lamp socket.

By combinations of fixed and variable resistances any load can be applied from 0.15 amp. to 30 amp. in steps of about 0.04 amp.

# Keep your relays operating *—accurately*

For unfailing electric service, relays must be kept in adjustment, whether installed in a generating station, substation or industrial plant. Use the Synchronous Timer and Load Box for this purpose. This simple equipment removes largely the element of human error in making such tests where the extremely small units of time involved make accurate results by other means impossible.

Where calibrating blocks are provided, relay tests and adjustments can be made without making any change in the circuits.

Bulletin 67781 gives details as to operation, capacities and application.

54A-117

# GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL LARGE CITIES

Relay switch designed for low operating current
Terminal board for motor, relay switch and motor connections
Positive limit switch
Oil gauge
Line drop compensator
Enclosed motor control switch
Slate finished ebony asbestos panel
Panel supports
Rapidly accelerating motor with positive quick-operating, noiseless magnetic brake
Fabroil pinion to reduce gearing noises
Hand wheel for operating regulator by hand
Heavy-duty bronze segment.
Eye bolts for lifting regulator out of tank
All-steel round tank to withstand high pressures
Terminal board at edge of panel for external connections
Contact making voltmeter
Straps for panel supports
Flanged steel base
Oil drain at extreme bottom of tank

# One year old

And our claims have now been verified. Operating companies from coast to coast have proved for themselves that this new G-E Regulator offers advantages equalled by no other regulator.

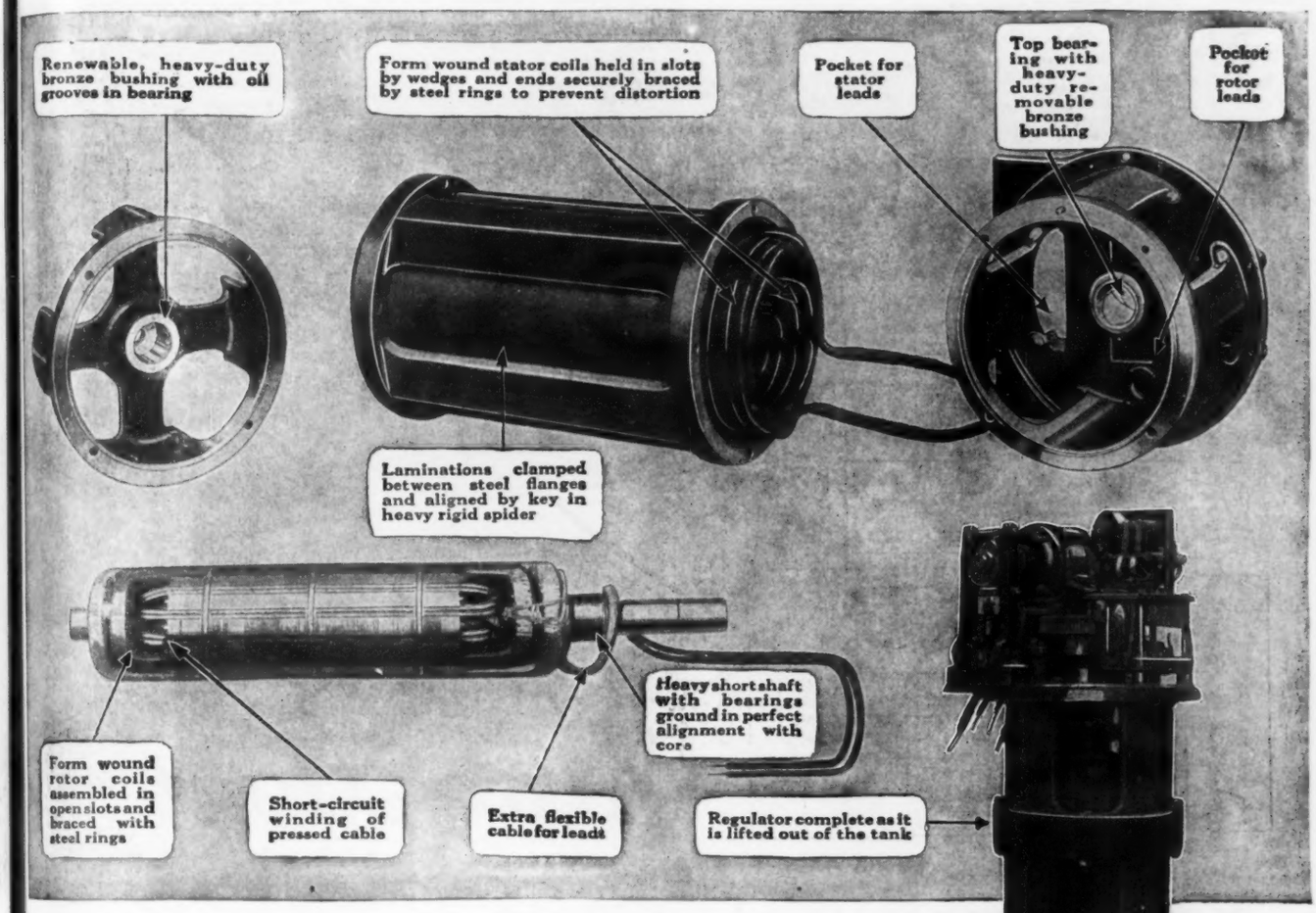
These regulators are available for inspection and test.

*Investigate*

*Bulletin 45450-A describes both this new Induction Regulator and G-E Automatic Generator Voltage Regulators. Your copy sent on request.*

**23 to 115 kv-a.**

GENERAL


Renewable, heavy-duty bronze bushing with oil grooves in bearing
Form wound stator coils held in slots by wedges and ends securely braced by steel rings to prevent distortion
Pocket for stator leads
Top bearing with heavy-duty removable bronze bushing
Pocket for rotor leads
Laminations clamped between steel flanges and aligned by key in heavy rigid spider
Heavy short shaft with bearings ground in perfect alignment with core
Form wound rotor coils assembled in open slots and braced with steel rings
Short-circuit winding of pressed cable
Extra flexible cable for leads
Regulator complete as it is lifted out of the tank

# the New G-E Induction Regulator

It is offered with the assurance that it will give you satisfactory service because:

—The tank is round, built of heavy boiler plate, a design ideal to withstand high internal pressures.

—A very rigid and compact mechanical structure insures quiet operation over a long period.

—The auxiliary apparatus is very conveniently arranged and accessible.

—Voltage changes are corrected more rapidly than by any other motor-operated induction regulator.

If you have not received literature fully describing this new design, tell the nearest G-E Sales Office.

**General Electric Company**
**Schenectady, N. Y.**
**Sales Offices in All Large Cities**

33-B51

ELECTRIC

# *Save Waste Heat*

## Recover generator losses with G-E Surface Air Coolers

### *Exclusive G-E Features*

Helically wound and shouldered copper fin designed for maximum heat transfer.

Extremely simple multi-pass water box with removable cover plate.

Individual tubes easily removed and replaced.

Non-corrodible, muntz-metal tube sheets, one inch in thickness.

Sherardized bolts and frame.

Heavy, rigidly welded, structural steel frame.

Simple, but rigid, tube support at center of tube bank.

The G-E Surface Air Cooler enables you to go one step further in raising your plant efficiency. It preheats your boiler feed water with heat that would otherwise be lost. It does this by using the turbine condensate to cool the ventilating air.

This Air Cooler operates in a closed ventilation system, which provides still other advantages:

Clean generator air
Less fire hazard
Simple ducts
Less noise

G-E Air Coolers can be installed for existing equipment without difficulty. By all means include them in new installations.

*Bulletin 45609*

21-54

# GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN ALL LARGE CITIES

*New Issue* *This advertisement appears as a matter of record only.* *December 17, 1924*

# *150,000 Shares*

# *Utilities Power & Light Corporation*

## *Class A Stock*

**Has Priority Over Class B Stock as to Both Assets and Dividends.**
**Fully Participating and Non-Callable**

**Shares are fully paid and non-assessable.** **Dividends not subject to Normal Federal Income Tax.**
**Authorized 150,000 shares** **This offering 150,000 shares.**

TRANSFER AGENT
American Exchange National Bank, New York

REGISTRAR
The Chase National Bank of the City of New York

Priority dividends of $2.00 per annum on the Class A Stock, when and as declared, shall be payable on the first days of January, April, July and October. Dividends on the Class A Stock are non-cumulative. After the full priority dividend on Class A Stock shall have been declared and provided for in any year and dividends for the Class B Stock shall have been declared and provided for in that year to the extent of the total amount required for such priority dividend on the Class A Stock, one-half of the amount of any further dividends in such year shall be paid to Class A Stock and one-half to Class B Stock.

The Class A Stock, issued without par value, has priority in liquidation or dissolution over the Class B Stock up to $35.00 per share. After this preferential payment to the Class A Stock is provided for and provision has been made for the distribution to the Class B Stock of an amount equal in the aggregate to the total of such preferential payment to the Class A Stock, one-half of the remaining assets shall be distributed ratably among the holders of the Class A Stock and one-half among the holders of the Class B Stock.

**It is the intention of the Corporation to make application immediately to list the Class A Stock on the New York Stock Exchange.**

*This stock is offered if, as and when issued and accepted by us and subject to approval of counsel and to prior sale.*

**Price: $25.00 per share**

*For information regarding this stock, we refer to the letter dated December 12, 1924, of Mr. H. L. Clarke, President of Utilities Power & Light Corporation, which he has summarized as follows:*

***Properties:*** Utilities Power & Light Corporation, incorporated in Virginia, controls directly or through subsidiaries, public utility systems operating in the States of Iowa, Minnesota, Wisconsin, Illinois and New Jersey. Among the companies controlled are Interstate Power Company, a Wisconsin Corporation, operating in southern Minnesota, northeastern Iowa and southwestern Wisconsin and owning the entire Common Stock of Dubuque Electric Company, Dubuque, Iowa; Eastern New Jersey Power Company, operating in the rapidly growing communities along the Atlantic Coast of eastern New Jersey within commuting distance of New York and Philadelphia; Atlantic Coast Transportation Company, Electric Light & Power Company, Hightstown, N. J., and Jamesburg Electric Company.

The systems furnish over 275 communities with one or more of the following public utility services: Electric light and power, gas, steam heat, water and electric railway. The population served is about 560,000. All the principal franchises of the companies are favorable and contain no burdensome restrictions. Over 90% of the net income of the properties is derived from the sale of electric light and power. The Interstate Power system is now being interconnected physically, thereby enabling the Management to effect large economies in operation as well as expansion of the business. During the past year the output of electrical energy of this system alone was in excess of 45,000,000 k.w.h. Business obtainable in the Eastern New Jersey Power Company's territory will require the installation of an additional unit to its present plant in the near future and the connection with the Interstate system of the Dubuque Electric Company property will necessitate doubling immediately the present capacity of its generating facilities.

In addition to the properties in the system operating as public utilities, the stockholders of Utilities Power & Light Corporation have a valuable equity in the Utilities Building Corporation, owning a modern 12-story office building in the "Loop" district, Chicago, Ill.

***Valuations:*** The properties of the public utility subsidiary companies of Utilities Power & Light Corporation have been valued recently at $25,515,741, after making allowances for depreciation which averaged about 8%. Included in this total, the portion applying to Interstate Power Company properties (as established by an appraisal) made by the Company's engineers) is $1,190,900 in excess of the valuation reported to the bankers by Day and Zimmerman, Inc. After including additional property, investments, cash, etc., of a total of $2,533,507, and allowing for funded debt and Preferred and Common Stocks of the subsidiaries, etc., presently outstanding and for the Corporation's Preferred Stock, there remain for the Class A and Class B Stocks more than $7,938,434. Together with the equity in the Utilities Building, the total of equities is at the rate of over $60 per share for the Class A Stock.

***Earnings:***

UTILITIES POWER & LIGHT CORPORATION AND SUBSIDIARY COMPANIES

Consolidated Statement of Earnings for Twelve Months ended July 31, 1924, of Corporation and companies owned or controlled on December 1, 1924.

| | |
|---|---|
| **Gross Income** | **$5,047,366.82** |
| **Operating Expenses, Maintenance, Renewals and Replacements, and Taxes, including reserve for Federal Income Tax** | **2,890,424.24** |
| **Net Income** | **$2,156,942.58** |
| **Interest on Funded Debt and Dividends on Preferred Stocks of Subsidiary Companies as well as proportion of Subsidiary Company Earnings applicable to their Common Stocks held by public** | **1 129,363.71*** |
| **Earnings accruing to Utilities Power & Light Corporation after reserves for Federal Income Tax but before amortization of debt discount and expense** | **$1,027,578.84** |
| **Annual dividend on $1,000,000 7% Preferred Stock Utilities Power & Light Corporation** | **70,000.00** |
| | **$957,578.84** |

* Deductions are on the basis of annual interest charges and dividend requirements on subsidiary company securities to be outstanding with public immediately after sale of this Class A Stock.

The balance of the combined net earnings, as shown, is at the rate of over $6.00 per share on the Class A Stock presently to be outstanding. No allowance has been made in this statement for the earnings of the Utilities Building Corporation whose stock is held in trust for the benefit of the Utilities Power & Light Corporation stockholders. The Management believes that the economies of operation resulting from the inter-connection of the properties of the Interstate Power system, together with new business to be obtained immediately by all properties, will increase the net earnings over $450,000 for the coming year, a large part of which should be evident during the next few months.

***Dividends:*** As the earnings of the Corporation and its subsidiaries are at a rate to warrant a distribution to the Class A Shares, and are expected to show a marked increase in the next few months, it is the intention of the Management to recommend to the Directors inauguration, during the quarter ending April 1, 1925, of dividends on the Class A Stock at the annual rate of $2 per share.

We do not guarantee the information given herewith, but it is taken from sources which we believe to be reliable.

*All legal matters in connection with the issuance of this stock will be passed upon by Messrs. Rushmore, Bisbee & Stern, New York City, for the Buying Group, and by Messrs. Mayer, Meyer, Austrian & Platt, Chicago, for the Corporation.*

*Valuations of the physical properties were made recently by Day and Zimmermann, Inc., Engineers, and examination of the Corporation's accounts has been made by Messrs. F. W. Lafrentz & Co., Certified Public Accountants.*

**PYNCHON & CO.**

**WEST & CO.** **W. S. HAMMONS & CO.** **JOHN NICKERSON & CO.**

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EMPIRE BUILDING, 71 BROADWAY, NEW YORK

*Manufacturers of Steel Structures of all classes, particularly*

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## Electric Bond and Share Company

(*Incorporated in* 1905)

Paid-up Capital and Surplus
$60,000,000

71 Broadway New York

**WE are always interested in purchasing issues of sound Public Utility securities.**

**BATTLES & CO.**

*Established 1890*

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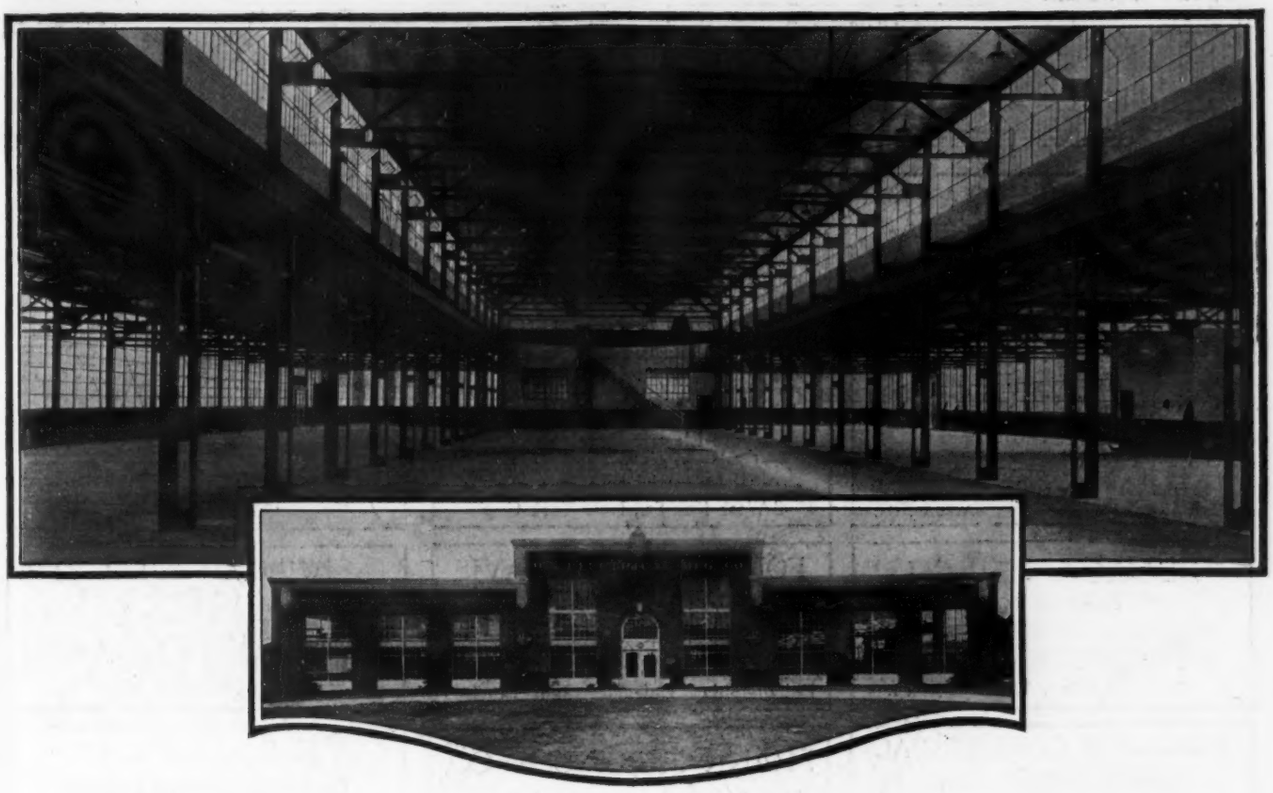

# 60,000 Sq. Ft. in 60 Working-Days

FOR 60,000 sq. ft. of floor space Austin will save you two to four months in construction time.

For example, 60,000 sq. ft. of Austin No. 10 Standard, permanent type of construction, illustrated above, equipped for 5- to 50-ton crane operation, will be completed in 60 working-days.

The Austin No. 10 Standard Building, of concrete, brick, and heavy rolled structural steel construction, is suited to general assembly and erecting work, machine shops, turbine shops, electrical equipment manufacturing, and for warehouse purposes.

The service offered in the No. 10 Standard is typical of Austin Service on the largest, most complex type of building project—complete plants or single factory buildings—multi-story or single story.

The Austin Unit Responsibility Plan shoulders the whole load of every detail of design, construction and equipment, under one contract carrying a guaranteed lump-sum price, a guaranteed delivery date with bonus and penalty clause if desired, and guaranteed quality of materials and workmanship throughout.

## *Some of the Reasons Why Austin Can Give You This Guaranteed Building Service*

**1** Large stocks of essential materials, such as structural steel, steel sash, glass, lumber, and standard factory doors, are maintained.

**2** Austin owns a great amount of labor saving equipment, such as locomotive cranes, steam shovels, hoists, etc., available over night for any job anywhere.

**3** Austin Standard or Special Buildings, designed for economical construction, meet every industrial requirement.

**4** Austin Standardized Structures are a profitable investment because of their adaptability to a variety of manufacturing purposes.

**5** A day saved in construction is a day gained in production. Your building will be ready for useful occupancy in 30, 60, or 90 working-days, depending upon the size.

**6** Austin's success through more than fifty years of experience guarantees building success *for you.*

**7** Austin localized, yet country-wide, building service is available through 13 Austin Branch Organizations.

**8** Austin Building Service is a complete service, including layout, design, construction and equipment which can be handled under one contract and with Unit Responsibility.

*Ask for helpful building information and data for your board meeting, whether your project is in Seattle, Birmingham, Syracuse or St. Louis. Wire, phone or use the coupon.*

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***Engineers and Builders***
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Excavation and Grading for standard foundations and floors. Based on normal site and conditions.

Concrete Foundations—Depth 4 feet below floors. Concrete floors 5 inches thick.

Brick Side Walls.

Rolled Steel Side Wall Sash, Fenestra, or equal. Glass, ⅛-inch factory ribbed.

Mechanical Sash Operators, for monitor sash.

Concrete Window Sills.

Structural Steel Frame with heavy rolled sections, center aisle columns punched for crane columns and girders.

Roof Structure, structural steel trusses, steel or yellow pine purlins and roof sheathing. Trusses designed to carry 2,000 lbs. at any panel point.

Roof Waterproofing, 4-ply built-up composition roofing.

***Austin No. 10 Standard Building. Width, 150 ft.; can be varied in multiples of 50 ft. Length, any multiple of 20 ft.***

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UNDISPLAYED—RATE PER WORD:
*Positions Wanted*, 4 cents a word, minimum 75 cents an insertion, payable in advance.
*Positions Vacant* and all other classifications, 8 cents a word, minimum charge $2.00.
*Proposals*, 40 cents a line an insertion.

INFORMATION:
*Box Numbers* in care of any of our offices count 10 words additional in undisplayed ads.
*Discount* of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:
1 to 3 inches.....$5.00 an inch
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*An advertising inch* is measured vertically on one column, 3 columns—30 inches—to a page.

E.W.

### POSITIONS VACANT

A-NO. 1 single-phase meter tester wanted; must have references as to ability; no others need apply. State education, experience and salary desired. P-143, Electrical World, 10th Ave. at 36th St., New York.

BOOKKEEPER to assume charge of consumer's ledger, billing, etc., about four thousand account in northeastern Nebraska. Must have man with gumption to assure prompt and accurate work. Man or woman required also for similar work in Minneapolis. State salary expected. P-127, Elec. World, Old Colony Bldg., Chicago, Ill.

CHIEF telephone engineer well up in British P. O. circuits, manual boards and instruments, by large firm of telephone manufacturers in England who are developing this side of their business. State age, salary required and when free. Strict confidence will be observed. Box No. 1202 Dorland Agency, Ltd. 14, Regent St., London, England.

DESIGNING electrical engineer. About three years' independent design experience on a.c. and d.c. motors preferred. Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland, Ohio.

DESIGNING engineer wanted, familiar with experimental and development work AC motors. State experience, salary, etc. P-120 Electrical World, Leader-News Bldg., Cleveland, Ohio.

ELECTRICAL draftsman experienced in power and substation design, with power company in New York State. Good chance for advancement. State age, education, experience and salary expected in first letter. P-119, Electrical World, 10th Ave. at 36th St., New York.

ELECTRICAL engineer with good technical training and about eight years' experience in electric light power and railway public utility work. Location, large city in Brazil. In applying please give full particulars regarding self and experience, stating also salary desired and when available. P-137, Electrical World, 10th Ave. at 36th St., New York.

ELECTRICAL designer, experienced in high tension substation work; must be capable of making complete contract drawings from sketches and of directing other men. State qualifications, experience, references and salary expected in first letter. Only first-class men need apply. Location, New York City. P-141, Electrical World, 10th Ave. at 36th St., New York.

ELECTRICAL engineer, college graduate, about ten years' experience in general public utility work desired by company operating foreign electric light power and railway utilities. Apply by letter stating full particulars of experience, when available and salary desired. Location, Toronto, Canada. P-138, Electrical World, 10th Ave. at 36th St., New York.

**BE A METER ENGINEER**

Get in the new profession. We can teach you meter engineering *by mail* at your own home during spare time. Successful graduates everywhere.

**Earn $3,600.00 a Year**

Central stations *must have Electrical Meter Engineers*. They pay high salaries. *Write today.* Just your name and address on a postal and we will send you full particulars free. Ft. Wayne Correspondence School, Dept. 46, Ft. Wayne, Ind.

### POSITIONS VACANT

METER and instrument testers—In the laboratory of a large concern manufacturing Watthour meters and electrical instruments. Graduates of technical schools, having knowledge of the theoretical and practical operations of electrical meters and instruments, preferred. Give age, complete details of education and experience in reply. P-139, Electrical World, 10th Ave. at 36th St., New York.

METERMEN—Positions open for a number of men with experience in testing instrument transformer meters. Meters with maximum demand equipment, generating and substation metering. Knowledge of mathematics and AC theory necessary. State education, experience, age. Salary, weekly rate, $30 to $40. P-142, Electrical World, 10th Ave. at 36th St., New York.

PROMINENT manufacturer of electrical equipment desires the services of graduate electrical engineers, preferably with some operating experience for interesting work in the design and application of switching equipments to large generating stations and substations. Includes both manual and automatic equipments, also other problems connected with the control and distribution of electrical service. P-144, Electrical World, Leader-News Bldg., Cleveland, Ohio.

### EMPLOYMENT SERVICE

EXECUTIVES, engineers, $3,000-$25,000, will find our individual, confidential service an effective medium in making new connections. Personally conducted by Mr. Jacob Penn, the eminent employment authority, known to leading business men throughout America. Our refund agreement protects you. Not employment agency. Jacob Penn, Inc., 305 Broadway, New York.

OVERTURES negotiated through the confidential correspondence service of the undersigned, for salaried positions $2,500 to $25,000—executive, mechanical, administrative, engineering, technical financial, manufacturing, sales, advertising, professional, etc., etc.; all lines. Established fourteen years; not an employment agency. Retaining fee refunded as provided in our "Refund Contract" if service is not satisfactorily rendered as per contract, and such refund be requested within three months from date remitted. Send name and address only for particulars. R. W. Bixby, Inc., 705 Lockwood Building. Buffalo. New York.

### POSITIONS WANTED

ACCOUNTING or other position desired by young man, preferably west or middle west. Thorough accountant, ten years' experience public utility work, five years' auditor, treasurer and assistant to manager, familiar with all detail records, accounting and considerable experience commercial, public relations, new business, tours, rates, rate cases and operating gas, electric, railway and bus departments, now employed but desire change. PW-146, Electrical World, 10th Ave. at 36th St., New York.

A FOREMAN or working foreman. Several years in hydro, steam and substation operation, maintenance and construction. Tactful, energetic. Available immediately anywhere. PW-106, Electrical World, Leader-News Bldg., Cleveland, O.

### POSITIONS WANTED

AS superintendent or manager of public utility. Thoroughly conversant with central station practice from power plant to consumer. Last 5 years superintendent of construction and district manager of property developing from 5,000 to 15,000 customers. Married, with family, but will go anywhere. PW-109, Elec. World, 10th Ave. at 36th St., New York.

ELECTRICAL engineering graduate, 25, two years with Westinghouse, desires position with public utilities or industrial company, preferably in the Southeast. Available on short notice. PW-114, Electrical World, Real Estate Trust Bldg., Philadelphia, Pa.

**To Employers Who Advertise for Men:**

The letters you receive in answer to your advertisements are submitted by each of the applicants with the hope of securing the position offered.

When there are many applicants it frequently happens that the only letters acknowledged are those of promising candidates. Others do not receive the slightest indication that their letters have even been received, much less given any consideration. These men often become discouraged, will not respond to future advertisements, and sometimes even question if they are bona fide.

**We** can guarantee that *Every Advertisement Printed in the Searchlight Section Is Duly Authorized.* Now won't **you** help keep our readers interested in this advertising by acknowledging **every** application received, even if you only return the letters of unsuccessful applicants to them marked, say, "Position filled, thank you." If you don't care to reveal your identity, mail them in plain envelopes.

We suggest this in a spirit of helpful co-operation between employers and the men replying to Positions Vacant advertisements.

***Searchlight Department***
**McGRAW-HILL CO., Inc.**

***"Put Yourself in the Place of the Other Fellow"***

6000

## POSITIONS WANTED

ELECTRICAL engineer with B.S. degree, Assoc. A. I. E. E.; age 27, single, desires position with progressive public utility company. Experienced with manufacturing and central station companies. Minimum salary $200 per month. Available 30 days. PW-108, Electrical World, Old Colony Bldg., Chicago, Ill.

ELECTRICIAN desires position in Central or South America. 15 years' experience in installing, operating, and repairing electrical machinery for mine work, steel plants, electric railways and power house operation. PW-133, Elec. World, Old Colony Bldg., Chicago, Ill.

ENGINEER, college graduate, 14 years' experience in design of electrical and construction and operation of electrical, steam and oil equipment. Desires position as chief engineer or electrical superintendent of industrial plant. At present employed; available after customary notice to present employers. PW-136, Electrical World, 10th Ave. at 36th St., New York.

EXECUTIVE position wanted with more promising future by man with broad practical experience in the manufacture and distribution of gas and electricity; also distribution of natural gas. Have operated successfully as executive of combined gas and electric properties for over nineteen years. Services available upon reasonable notice to present employers. PW-130, Elec. World, 10th Ave. at 36th St., New York.

MAN experienced in steam, hydro and substation operations and electrical construction, wishes employment at once. PW-111, Electrical World, Old Colony Bldg., Chicago, Ill.


# SEARCHLIGHT SERVICE

**Covers the advertising of**

Agencies Wanted
Agents Wanted
Auction Notices
Bids Wanted
Books and Periodicals
Buildings for Sale
Business Opportunities
Civil Service Opportunities
Contracts to Be Let
Contracts Wanted
Desk Room for Rent
Desk Room Wanted
Educational
Employment Agencies
Evening Work Wanted
Foreign Business
For Exchange
For Rent
Franchises
Industrial Sites
Labor Bureaus
Machine Shops
Machinery Wanted
New Industries Wanted
Partners Wanted
Patent Attorneys
Patents for Sale
Plants for Sale
Positions Vacant
Positions Wanted
Property for Sale
Proposals
Receivers' Sales
Representatives Wanted
Salesmen Want Connections
Salesmen Wanted
Second Hand Equipment
For Sale For Rent
Exchange Wanted
Specialties
Tutoring
Vacation Work Wanted
Water Front Property
Work Wanted
Miscellaneous for Sale for Rent or Want Ads.

**Can we serve you?**

0150


## POSITIONS WANTED

GRADUATE electrical engineer, age 35, single, with executive ability, available for responsible position with public utility, preferably affording an opportunity to develop in management. Thirteen years' varied technical and commercial experience with large gas and electric companies covering operation, power sales, rates, engineering and construction on lines and stations. PW-122, Electrical World, Old Colony Bldg., Chicago, Ill.

MAN of 39, technical graduate, desires position with public utility in new business or property management departments. Eleven years' experience with contracts, rates, franchises and management questions. PW-123, Electrical World, Real Estate Trust Bldg., Philadelphia, Pa.

TRANSMISSION: engineer, 25 years' practical experience. Sixteen municipal systems constructed and operated. Highest references. Available at once. Go anywhere. PW-145, Elec. World, 10th Ave. at 36th St., New York.

WANTED—Position as assistant superintendent or general foreman of overhead construction; available after January first. PW-129, Elec. World, Real Estate Trust Bldg., Phila., Pa.

WANTED position as manager of combination gas and electric property in town of at least 20,000 population. PW-76, Electrical World, Old Colony Bldg., Chicago, Ill.

METERMAN—Two years' technical training, four years' practical experience meter and current transformer testing, repairing. I. C. S. student, available 30 days. PW-99, Electrical World, Old Colony Bldg., Chicago, Ill.

SALES and new business manager, age 32, married. Technical and business training; 10 years' experience. Now employed. Desires position with greater possibilities. Full details upon request. PW-131, Elec. World, 10th Ave. at 36th St., New York.

SWITCHBOARD operator and construction man with several years' experience, desires immediate employment. PW-110, Electrical World, 10th Ave. at 36th St., New York.

## SALESMAN WANTED

**Sales Engineer**

to call on power companies and central stations. Must be acquainted with buyers in central Western states. Prefer man familiar with transmission towers, steel substations and pole line hardware. SW-140, Electrical World, Old Colony Bldg., Chicago, Ill.

## REPRESENTATIVE WANTED

**Wanted: Traveling Sales Representative**

by established wire manufacturer. Require good personality, experience in electrical industry; age 30 to 40 and references. Technical education and acquaintance with electrical jobbers and central stations desirable. Reply to RW-135, Electrical World, 10th Ave. at 36th St., New York.

## BOOKS AND PERIODICALS

**Motor Winders!**

Printed book containing data for electric motors of twelve leading manufacturers. Gives actual winding information, wire size, turns, pitch, connection, etc. Also electrical connecting diagrams for most any device. Alternating and direct current motors, transformers, controllers, compensators, rotors, automobile armatures, etc. Samples and circular free. Charles Chittenden, W3024 Matthews, Ave., Kansas City, Missouri.

## OFFICIAL PROPOSALS

Bids: Jan. 6.

**Power Machinery**

Franklin, N. C.

Sealed bids will be received up to 10 a.m., Tuesday, January 6th, at the offices of the Engineers, Robert & Company, Inc., 7th floor, Bona-Allen Building, Atlanta, Georgia, on the following machinery:

2 750 Hp. water turbines with governors.
2 650 Kva. Generators with Exciters.
1 Switchboard.
2 750 Kva. Power Transformers.
Miscellaneous equipment.

All for the hydro-electric plant being constructed for the Town of Franklin, North Carolina.

The right is reserved to reject any or all bids. Any part of any bid may be accepted and the balance rejected.

All bids must be accompanied by a certified check for $500.00, payable to the Town of Franklin, N. C., or by a similar bidder's bond.

Detailed specifications may be obtained from the Engineers at the above address. No charge is made for these specifications.

Town of Franklin, N. C.

R. D. SISK,
Mayor.
H. W. CABE,
Town Clerk.

Engineers:
ROBERT & COMPANY, INC.,
Atlanta, Georgia.


**? Are you interested in ?**

# CONDENSERS

**Apparatus for accumulator-charging from A. C. and D. C.**

***! ! We make them ! !***

**Address demands to:**

**Elektrizitaets-Aktiengesellschaft Hydrawerk**

**Berlin Charlottenburg 5/E.W.**
**— founded 1899 —**

# WANTED

**Always in the Market for GOOD USED**
**MOTORS—GENERATORS—PLATING DYNAMOS**
**Mail descriptive price lists for quick action. Let Us Have YOUR Requirements**
**TRIANGLE ELEC'L & MCHY. EXC., INC.**
**183 Centre St., New York City**
Phone: Franklin 1046

**WANTED**

## Motor Generator Set

Used, 400 or 500 kw. with synchronous motor either 440 or 2200 v., 3 ph., 60 cy.; generator 250 v. d.c., with starting devices and switchboard.

**The Waterbury Farrel Foundry & Machine Co.**
Waterbury, Conn., U. S. A.

# The Second Shipment of 3 Phase 60 Cycle General Electric KT Motors

**from the Lincoln Works of the Ford Motors Co., Detroit**

is now being received, and consists of sizes every one uses, and sells every day. All these motors were put in at the time this model factory was completed only a few years ago—all kept in the finest condition by the Ford people in the Ford way. They were replaced by direct-current motors, for engineering reasons, and not taken out because defective or obsolete. Hundreds of other first-class motors, squirrel cage and slip ring types—all fully tested and sent out practically new.

The response of our customers shows that they appreciate a *real Bargain Opportunity* like this—the stock is unusually large so that we can supply almost any reasonable demands.

**You can save 35 to 50 per cent. on every reconditioned motor we ship you—send for our *Monthly Bargain Sheet* and get our prices. Why? Because the motors are *good* and *cheap now.***

**GREGORY ELECTRIC CO.**

16TH AND LINCOLN STS. CHICAGO, ILL.

**USED ELECTRICAL MACHINERY.**

**This company is not a second-hand dealer in the generally accepted sense. The Gregory shop is not a storeroom of second-hand machinery. It is a fully equipped, thoroughly manned factory—and the work is to thoroughly rebuild and test everything sold.**

# J.L.HEMPHILL & CO. Inc.

## ELECTRICAL ENGINEERS AND EQUIPMENT

801-807 Williams St. North Bergen. N.J.

**Telephones: Palisade 2600-2601**

### A. C. MOTORS—3 PHASE, 60 CYCLE

| No. | Hp. | Rpm. | Volts | Type |
|---|---|---|---|---|
| 1 | 400 | 450 | 2200 | G. E., synch. |
| 2 | 200 | 900 | 220/440 | G. E., L |
| 1 | 200 | 225 | 2300 | G.E., synch. |
| 1 | 200 | 720 | 2200/440 | Cr. Wh., sl. rg. |
| 1 | 180 | 400 | 440/2300 | Burke, sl. rg. 3 brg. |
| 1 | 150 | 900 | 220/440 | Allis-Chal. syn. |
| 1 | 150 | 720 | 2200 | G. E., sl. rg. |
| 1 | 150 | 600 | 220/440 | Cr. Wh., sq. cg. |
| 1 | 150 | 900 | 2300 | G. E., syn. |
| 1 | 100 | 257 | 2300 | G. E., syn. |
| 1 | 100 | 900 | 220/440 | Ideal, sq. cg. |
| 1 | 100 | 680 | 220 | Cr. Wh., sq. cg. |
| 1 | 75 | 490 | 440 | Allis Chal. S.R. |
| 3 | 50 | 900 | 440 | West., CCL |
| 1 | 50 | 900 | 220/440 | G. E., sl. rg. |
| 1 | 50 | 900 | 220/440 | Westghse., sl.rg. |
| 3 | 50 | 900 | 220/440 | West., sq. cg. |
| 1 | 50 | 720 | 550 | Burke, SR. |
| 1 | 40 | 1700 | 220/440 | Westghse., sl.rg. |
| 1 | 40 | 720 | 220/440 | West., sq. cg. |
| 1 | 35 | 1200 | 220 | Cr.-Wh., syn. |
| 1 | 25 | 1200 | 2200 | G. E., S.R. |
| 1 | 25 | 1200 | 220/440 | Allis Chal. |
| 1 | 25 | 720 | 220/440 | G. E., K |
| 1 | 25 | 900 | 220/440 | G. E., K |
| 1 | 20 | 900 | 220/440 | G. E., sq. cg. |
| 3 | 20 | 1200 | 220/440 | G. E., sq. cg. |
| 3 | 15 | 1200 | 220/440 | G E., K |
| 3 | 15 | 1800 | 220/440 | G. E., KT |
| 9 | 10 | 1200 | 220/440 | G. E., KTI |
| 1 | 7½ | 1200 | 220/440 | Allis Chal. |
| 2 | 7½ | 900 | 220/440 | G. E., MT |
| 1 | 5 | 1800 | 220/440 | Westg. |
| 10 | 5 | 1200 | 220/440 | G. E., KT |
| 1 | 3¼ | 600/1800 | 440 | G. E., new var. speed |
| 4 | 3 | 1200 | 220/440 | G. E., KTI |
| 5 | 2 | 1800 | 220/440 | G.E. |

*2 Phase Motors on request*

### D. C. GENERATORS—250 VOLT

| No. | Kw. | Rpm. | Type |
|---|---|---|---|
| 1 | 250 | 420 | Allis Chal. |
| 1 | 90 | 750 | G. E. |
| 1 | 75 | 550 | Diehl |
| 1 | 50 | 600 | Westghse. |
| 1 | 30 | 1000 | Westghse. |

*Smaller sizes on request.*

### D. C. GENERATORS—125 VOLT

5, 10, 20, 22, 35, 50, 75 kw.

### D. C. MOTORS—230 VOLT

| No | Hp. | Rpm. | Type |
|---|---|---|---|
| 1 | 100 | 625 | G. E. |
| 1 | 75 | 850 | Diehl |
| 1 | 50 | 200 | Diehl |
| 1 | 50 | 650 | Sprague |
| 1 | 40 | 400 | Diehl |
| 1 | 40 | 1300 | Diehl |
| 1 | 35 | 200 | Diehl |
| 1 | 35 | 700 | Cr. Wheeler |
| 1 | 35 | 420 | Diehl |
| 1 | 30 | 500 | Diehl |
| 1 | 25 | 600 | Sprague |
| 1 | 25 | 500/1500 | Allis Chalmers |
| 1 | 20 | 665 | Diehl |
| 1 | 20 | 200 | Diehl |
| 1 | 20 | 900 | Diehl |
| 1 | 15 | 1050 | Cr. Wheeler, CM |
| 2 | 10 | 275/1500 | Allis Chalmers |

*Smaller sizes on reques*

### D. C. MOTORS—125 VOLT

| | | | |
|---|---|---|---|
| 1 | 200 | 680 | G. E. DMC |
| 1 | 75 | 850 | West. SK |
| 1 | 20 | 650 | G. E. |
| 1 | 15 | 775 | SK, Westg. |
| 1 | 5 | 700 | Diehl |
| 1 | 5 | 3×5 | G. E. vert. |
| 3 | 3 | 1100 | G. E. |
| 2 | 3 | 1700 | G. E. |

### A. C. GENERATORS

| No. | Kw. | Rpm. | Volts | Ph. | Type |
|---|---|---|---|---|---|
| 1 | 300 | 450 | 2300 | 3 | G. E., P. |
| 1 | 100 | 900 | 2300 | 3 | G. E., P. |
| 1 | 75 | 1200 | 220/440 | 3 | Cr.-Wheeler |
| 1 | 30 | 1200 | 220 | 3 | Westghs |

### TURBINES

1—625 kva. Westinghouse Parsons 480 volt, 3 ph., 3600 r.p.m., complete, mixed pressure.
1—475 kva., 3600 r.p.m., 3 ph., 60 cy., 220/440 v., Westinghouse, non-condensing, with direct connected exciter.
1—150 kw. De Laval, D. C., Crocker-Wheeler, 3 wire, 125/250 v. Complete, operated one year

### ENGINE GENERATOR SETS

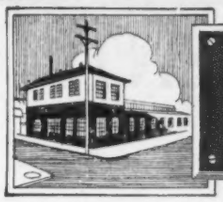
1—500 kw., 250 v., D.C. G. E. Uniflow Engine Set, Brand New.
1—200 kw., 250 v., D.C. Gen., connected to Allis Chal., 18x36 right hand Corliss Engine.
1—150 kw. Bullock, 120 v., D.C. Generator, 150 rev., dir. conn. to 17x24 Fitchburgh engine.
1—150 kw., 200 rev., 125/250 v., 3 wire G. E. engine type (generator only).
1—100 kw., 125 v., 2 wire, D.C. Westinghouse R.H. gen., conn. to Harrisburg std. tand. cud., 11x18x13 engine, 275 r.p.m., complete.
1—75 kva. General Electric, 257 r.p.m., 3 ph., 60 cy., 440/2300 v., dir. conn. engine generator sets,
1—new 30 kva. G. E., 60 cycle, 3 phase, 2300 volt Generator, direct connected 45/60-hp. Mianus Improved Diesel engine, complete with switchboard. (Will reconnect to 220 or 440 volts.)

### MOTOR GENERATOR SETS

1—500-kw. Nat'l Brake & Elec. Co., 250/300-v 600-rev., direct connected 550 kw. synchronous motor, 2200/4400 v., with direct connected exciter.
300 kw., 500 v., 3 ph., 60 cy., 2300 v. Westinghouse syn. motor generator set.
250 kw., 450-250 v. Al. Ch. Gen., 375 hp., 2300 v. G. E. Syn. Motor.
200 kw., 250 v. G. E. Generator, with 300 hp., 2300/440 v. G. E., form K motor, 900 r.p.m.
150 kw., 125 v. General Electric, DMC gen. direct connected to 3 ph., 60 cy., 220/440 v. motor
100 kw., 250 v. Gen., 900 r.p.m., 2200 synchronous motor.
50 kw., 720 rev., 250 v. Gen.; 75 hp.; 220/440 v. motor.
10-20-25-40 kw., 125 v. Exciter Sets.
5 kw. Balancer Set.

### TRANSFORMERS

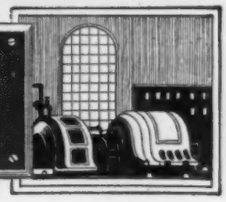
1—3 ph., oil insulated, self cooled, O. D.; type 5000 kva., 44,000 v. delta, 2,000 v. Y. Now connected 22,000 v. delta, high side—11,000 v. low side.
4—Type H, 150 kva.; 50 cy.; 8000/2300 v. G. E., form KDD, brand new.



# STEPHEN HALL & CO.

Incorporated

7th and Adams St's, Hoboken, N.J.



TELEPHONES: New York Direct Wire: Rector 3891; HOBOKEN 3750

## New and Used Electrical Equipment—Condition Guaranteed—Ready to Ship

**Slip Ring Motors—3-Phase, 60-Cycle**

| Hp. | Volts | Speed | Make | Type |
|---|---|---|---|---|
| 400 | 440/220 | 514 | General Electric | M |
| 250 | 2200 | 600 | General Electric | M |
| 200 | 2200 | 600 | General Electric | M |
| 200 | 220/440 | 600 | General Electric | M |
| 150 | 2200 | 600 | General Electric | M |
| 150 | 2200 | 720 | General Electric | M |
| 150 | 550 | 600 | General Electric | M |
| 150 | 220/440 | 600 | General Electric | M |
| 100 | 440/220 | 900 | General Electric | M |
| 100 | 2200 | 720 | General Electric | M |
| 100 | 440/220 | 720 | General Electric | M |
| 100 | 550 | 720 | General Electric | M |
| 75 | 550 | 720 | General Electric | M |
| 75 | 2200 | 720 | General Electric | M |
| 75 | 220/440 | 720 | General Electric | M |
| 75 | 220/440 | 900 | General Electric | MT |
| 55 | 440/220 | 514 | General Electric | M |
| 55 | 550 | 514 | General Electric | M |
| 50 | 550 | 900 | General Electric | M |
| 50 | 440/220 | 900 | General Electric | M |
| 50 | 2200 | 900 | General Electric | M |
| 50 | 440/220 | 600 | General Electric | M |
| 35 | 440/220 | 900 | General Electric | M |
| 35 | 2200 | 900 | General Electric | M |
| 35 | 550 | 900 | General Electric | M |
| 35 | 440/220 | 600 | General Electric | M |

**DIRECT CURRENT MOTORS**

| | | | | |
|---|---|---|---|---|
| 350 | 230 | 450 | General Electric | MPC |
| 200 | 230 | 800 | General Electric | RC |
| 175 | 115 | 525 | Crocker-Wheeler | Interpole |
| 125 | 115 | 500 | Westinghouse | Interpole |
| 75 | 115 | 400 | Crocker-Wheeler | D |
| 50 | 115 | 750 | Westinghouse | SK |
| 50 | 220 | 525 | Westinghouse | S |
| 50 | 220 | 950 | Westinghouse | S |
| 40 | 220 | 950 | Westinghouse | S |
| 40 | 230 | 1150 | Westinghouse | SK |
| 35 | 230 | 700 | Crocker-Wheeler | I |
| 30 | 110 | 575 | Westinghouse | S |
| 25 | 230 | 750 | Crocker-Wheeler | I |
| 20 | 230 | 900 | Westinghouse | SK |
| 15 | 230 | 1250 | Allis-Chalmers | Interpole |
| 13 | 220 | 630 | Westinghouse | S |

**3-Phase, 25-Cycle Motors**

| | | | | |
|---|---|---|---|---|
| 200 | 440 | 500 | General Electric, sl. rg. | |
| 25 | 220/440 | 750 | Burke sq. ca. | |
| 15 | 220/440 | 750 | Burke sq. ca. | |

**Squirrel Cage—3-Phase, 60-Cycle Motors**

| | | | | |
|---|---|---|---|---|
| 125 | 440/220 | 900 | General Electric | K |
| 100 | 440/220 | 900 | General Electric | K |
| 100 | 440/220 | 720 | General Electric | K |
| 100 | 2200 | 1200 | General Electric | KT |
| 75 | 2200 | 720 | General Electric | K |
| 75 | 440/220 | 720 | General Electric | K |
| 75 | 550 | 514 | General Electric | K |
| 55 | 550 | 514 | General Electric | K |
| 50 | 440/220 | 1200 | General Electric | K |
| 50 | 440/220 | 900 | General Electric | K |
| 40 | 550 | 900 | Westinghouse | CS |
| 40 | 440/220 | 900 | General Electric | KT |
| 35 | 550 | 900 | General Electric | K |
| 35 | 220/440 | 900 | General Electric | K |
| 30 | 220/440 | 900 | General Electric | KT |
| 25 | 220/440 | 900 | Westinghouse | CS |
| 25 | 440/220 | 900 | General Electric | KT |
| 25 | 220/440 | 720 | General Electric | K |
| 20 | 220/440 | 900 | General Electric | K |
| 15 | 220/440 | 1200 | General Electric | K |

**DIRECT CURRENT GENERATORS**

| Kw. | Volts | Speed | Make | Type |
|---|---|---|---|---|
| 300 | 250 | 500 | General Electric | MPC |
| 200 | 125 | 600 | Crocker-Wheeler | Interpole |
| 175 | 250 | 950 | General Electric | RC |
| 125 | 125 | 580 | Westinghouse | Interpole |
| 125 | 250 | 560 | Sprague | |
| 75 | 250 | 850 | General Electric | D |
| 70 | 125 | 475 | Crocker-Wheeler | D |
| 62½ | 125 | 280 | Sprague | .... |
| 60 | 125 | 925 | Sprague | D |
| 50 | 125 | 900 | General Electric | MP |
| 50 | 125 | 850 | Westinghouse | SK |
| 45 | 125 | 975 | General Electric | CLB |
| 40 | 250 | 875 | General Electric | CLB |
| 40 | 250 | 1100 | Crocker-Wheeler | I |
| 35 | 125 | 775 | Sprague | D |
| 12 | 250 | 600 | Westinghouse | SK |

**MOTOR GENERATOR SETS**

1—325-kw., 250-volt, 514-r.p.m. Gen. Elec. MPC Interpole Generator coupled to 500 hp., 2300-volt, 3-ph., 60-cy. Gen. Elec. Form K, sq. ca. motor.

1—175-kw., 125-volt, 600-r.p.m. Crocker-Wheeler Interpole Generator, coupled to 240-hp., 2200-440-volt, 3-ph. 60-cy. General Electric synchronous motor.

1—75-kw., 125-volt, 1150-r.p.m. Westinghouse Type SK Generator connected to 112 H.P. 220/440-volt, 3-ph., 60-cy. Westinghouse Type CS Motor.

**TRANSFORMERS**

2—200-kva. Gen. Elec., type H, 2300-volt, prim. 230/460-volt Scott connected sec.

**ALTERNATING CURRENT GENERATORS**

1—112½-kva., Gen. Elec. 480/240-v. 900-r.p.m. 3-ph. 60-cy. Type ATB. with dir. con. exciter.

2—100-kw., Gen. Elec. 2300-v. 900-r.p.m. 3-ph. 60-cy. Type ATB with belted exciter.

1—75-kw. General Electric, 2300/480//240 volt, 1200 r.p.m., 3-ph., 60 cy. Type TRB with belted exciter.

**TURBO-GENERATORS**

3—500-kw., Westinghouse, 2300/550/440-volt, 3600-r.p.m., 3-ph., 60-cy. turbo-generators, with barometric condensers.

**ENGINE GENERATOR SETS**

1—30-kw., 250-volt, 300-r.p.m. Gen. Elec., D.C. Generator, dir. conn. to 10x10 Ames Engine.

1—25-kw., 125-volt, 300-r.p.m. Western Electric, D.C. Generator, dir. conn. to 8x10 Ball & Wood Engine.

1—375-kva., 2300/480/240-volt, 240-r.p.m., 3-ph. 60-cy. Westinghouse engine type Generator without engine.

*If your requirements are not listed, write us, as we do not attempt to list our entire stock.*

---

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# "SPECIALS"

GUARANTEED

3—100 kva. Wagner type 11 R.O.B., 1 ph., 60 cy., 4600 v. prim., 115/230 v. sec. Transformers. Specification 2630. Surplus by reason rearrangement. Just taken out of service, attractive price to move quickly F.O.B. cars, Detroit.

1—150 hp. Gen'l Elect. type I, form K, 3 ph., 60 cy., 220 v., 575 r.p.m. with compensator, no base or pulley, now in service, shipment Nov. 15, 1924. Attractive price F.O.B. cars, Detroit, Mich.

3—250 kw., 312 kva., 3 ph., 60 cy., 2300 v., Gen'l Elec. 200 r.p.m. Generators direct connected 20x22-in. Skinner Unaflow Engines. These are New (unused) outfits.

200 kw., 250 v. D.C. Westinghouse 3 ph., 60 cy., 2200 v., 870 r.p.m. Induction Motor Generator Set. Generator type SK, motor type CS, can furnish with or without 125 v., 3-wire attachments. This is a modern machine, splendid condition and priced low.

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---

## Rotary Converter, 60 Cycle

1—500 kw. type H.C. General Electric 6-ph., 60-cy., 600 r.p.m. Class 12-500-600, 600-v. D.C., 833 amps., rotary converter.

## Direct Connected Alternating Current Units

1—310 kw. General Electric type ATB., 3-ph., 60-cy., 550-v., 164 r.p.m. alternator direct connected to 20x32-in. Rice & Sargent Corliss Valve, left hand, side crank double eccentric engine.

1—75 kva. Westinghouse 3-ph., 60-cy., 2300-v. (Can be reconnected for 550 v.), 257 r.p.m. alternator, direct connected to 14x14-in. Erie City engine.

## Alternating Turbo Driven Units, 60 Cycle

1—500 kw. Allis-Chalmers Turbine, 3600 r.p.m., 3-ph., 60-cy., 2300-v. (Can be rewound for any standard 3-ph. voltage) with C. H. Wheeler Surface Condenser.

1—125 kva. Self-contained Turbo Unit, consisting of Burke Elec. Co. alternator, 3-ph., 60-cy., 480-v. and Kerr Turbine, 125 lb. steam non-condensing, speed 3600 r.p.m.

1—75 kva. Self-contained Turbo Unit, consisting of Burke Elec. Co. alternator, 3-ph., 60-cy., 480-v., 3600 r.p.m., and Kerr Turbine for exhaust pressure service 6 lb. condensing duty.

## Induction Motors

1—400-hp. Gen. Elec. 3-ph., 60-cy., 440-v., 514 r.p.m., three bearing Slip Ring Type.

1—250-hp. Westinghouse 3-ph., 60-cy., 2300-v., 580 r.p.m., two bearing Squirrel Cage Type.

**Transformers and Motors of Every Description.**
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98—2500 volt, 30 to 600 amps., ratios from 6/1 to 80/1.
39—7500 volt, 10 to 1500 amps., ratios from 2/1 to 300/1.
100—15,000 volt, 5 to 400 amps., ratios from 1/1 to 80/1.

General Electric 25 to 125 cycle Potential Transformers.

| *No.* | *Volts* | *Watts* |
|---|---|---|
| 2 | 440-110 | 50 |
| 34 | 2,200-110 | 200 |
| 14 | 4,400-110 | 200 |
| 30 | 6,600-110 | 200 |
| 3 | 13,000-110 | 200 |

### BLOWERS

2—Sturtevant exhausters No.5 ½ type A.10,000 c.ft

### CHOKE COILS

3—G.E. 4600 volt on marble slabs
6—G.E. 660 volt on marble slabs

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Worthington 7,000 sq.ft.
Wheeler 8,000 sq.ft.
Wheeler 16,000 sq.ft.

### EXCITERS

75 K.W. Turbo exciter DeLaval
35 K.W. Turbo exciter Curtis

### FANS—D. C.

Stationary — oscillating — exhaust — ceiling G. E., Westinghouse and other makes

| *No.* | *Size, In.* | *No.* | *Size, In.* |
|---|---|---|---|
| 6 | 6 | 6 | 10 |
| 27 | 8 | 188 | 12 |
| 27 | 8 | 153 | 16 |
| 11 | 56 in. ceiling fans | | |
| *Exhaust* | | | |
| 2 | 24 | 51 | 56 |
| 1 | DeVilbiss | | |

### CABLE

No. 6 2300 volt, 3 cond. on hand, 1,332 ft.
No. 2 2300 volt, 3 cond. on hand, 1,851 ft.
No. 1/0 6600 volt, 3 cond. on hand, 190 ft.
No. 2/0 6600 volt, 3 cond. on hand, 584 ft.
No. 3/0 6600 volt, 3 cond. on hand, 4,868 ft.
No. 4 13,200 volt, 3 cond. on hand, 3,761 ft.

### FREQUENCY CHANGERS

**25 to 60 Cycle**

Generator, 2300 volt, 62 ½ cycle
Motor, 2300 volt, 25 cycle
3 500 kva., General Electric.
Generator, 2400 volt, 62 ½ cycle.
Motor, 6600 volt, 25 cycle.
1000 kva. General Electric.
Generator, 2400 volt, 62 ½ cycle.
Motor, 6600 volt, 25 cycle.
1250 kva. General Electric.
Generator, 2400 volt, 62 ½ cycle.
Motor, 6600 volt, 25 cycle.

### ROTARY CONVERTERS

1—750 KW., 275 volt, 250 RPM., 25 cycle type HC., 1—G.E. transformer, 825 KVA. 3/6 phase, 6600/186 volts.
1—1500 KW., 275 volts, 214 RPM., 25 cycle type HC., 3—Maloney single phase, transformers, 750 KVA., 13,200—460/220 volt; 25 cycle.
1—1500 KW., 225-275 volts, 214 RPM., 25 cycle, type HCB., 1—G. E. transformer; 1650 KVA., 3-6 phase, 6600-186 volts
1—2000 KW., 225/300 D.C. volt, 300 RPM., 25 cycle type HCC., 1—G.E. transformer, 2200 KVA., 3-6 phase, 6930-195 volts.
2—200 KW., 125 volt, D.C. transformer for 25 cycle side.
All above with equipment necessary for operation.

### MOTORS

**3-Phase, 25-Cycle Motors, Squirrel Cage.**
**Standard Makes**

| | | |
|---|---|---|
| 11—15 hp. | 10— 50 hp. | 7—150 hp. |
| 4—30 hp. | 2— 60 hp. | 1—350 hp. |
| 11—35 hp. | 8— 75 hp. | 1—375 hp. |
| 11—40 hp. | 1—100 hp. | 1—450 hp. |
| | **Slip Ring** | |
| 1— 5 hp. | 1— 20 hp. | 1—112 hp. |
| 2—10 hp. | 1— 22 hp. | 1—300 hp. |
| 1—11 hp. | 1— 30 hp. | 1—450 hp. |
| 4—15 hp. | 1— 40 hp. | 1—750 hp. |

**D. C. Elevator Motors**

Otis and other makes of elevator motors, various sizes, prices low enough to purchase for spare equipment.

### INDUCTION REGULATORS

| *No.* | *Make* | *Amp.* | *Phase* | *Voltage* |
|---|---|---|---|---|
| 4 | Westinghouse 16 ⅔ | 150 | 1 | 2200 |
| 1 | Gen. Elec. 17 ½ | 150 | 1 | 2300 |
| 3 | Gen. Elec. 22 | 100 | 1 | 2200 |
| 1 | Gen. Elec. 33 | 150 | 1 | 2200 |

### LIGHTNING ARRESTERS

| *No.* | *Make* | *Type* | *Volts* |
|---|---|---|---|
| 2 | Gen. Elec. | H | 6900 |
| 1 | Gen. Elec. | H | 4600 |
| 1 | Gen. Elec. | H | 9200 |

### METERS

No. 116—Twenty-five cycle watthour meters. General Electric and Westinghouse, two and three wire, single and three phase, 5 to 1000 amps.
No. 814—D.C. watthour meters, Gen. Elec. and Westinghouse, two and three wire, 5 to 300 amps. type M.

***This Is Not a Complete List of Available Equipment.***

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1— 75 hp. Burke Elec. EMV, 450 r.p.m.
2— 60 hp. Burke Elec. EMV, 514 r.p.m.
1— 15 hp. Gen. Elec. MT-310, 1125 r.p.m.

**D.C. VARIABLE SPEED MOTORS—230 Volts**

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**15½ kva. General Electric, 3 phase, 60 cycle, 440 volt primary, 200 volt secondary, type IRT 2—15½, form F71, with ½ hp., 3 phase, 60 cycle 110 volt, 900 r.p.m., type KT, form C, General Electric motor.**

**Tirrell Voltage Regulators**

**2—General Electric, 125 volt, type TD125, form K4**
**1—General Electric, 125 volt, type, TD125, form G**
**2—General Electric, 100/125 volt, type TA125, form A2, 25/125 cycle, with 70—140 volt DC exciters.**

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1—150 hp., 490 r.p.m., 440 v., 25 cy., Allis-Chalmers.
1—100 hp., 900 r.p.m., 220 v., 60 cy., General Electric.
1— 55 hp., 514 r.p.m., 220 v., 60 cy., General Electric.
2— 50 hp., 720 r.p.m., 220 v., 60 cy., General Electric.
Many other sizes, 25 and 60 cycle.

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A Surety Bond, backed by one of the leading Surety Companies of the country, backs this guarantee, assuring you of the highest quality motor and at a price much lower than that of a new motor.

See the Big Motor List on Pages 50-51
Electrical World, Dec. 6

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**Elliott Electric Company....813 Superior Ave., W., Cleveland, Ohio**
**Miller-Seldon Electric Company..1930 McGraw Ave., Detroit, Mich.**
**Willey-Wray Electric Company,**
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# MOTORS That Are Priced Right

### 3 Phase, 60 Cycles

| *Qu.* | *Hp.* | *Make* | *Volts* | *Type* | *Speed* |
|---|---|---|---|---|---|
| 1 | 500 | Crocker-Wheeler, synchronous | 440 | ..... | 1200 |
| 1 | 300 | Allis-Chalmers, synchronous | 440 | ..... | 600 |
| 1 | 300 | General Electric, slip ring | 440 | PT140 | 450 |
| 1 | 250 | General Electric, synchronous | 2300 | ATB | 600 |
| 1 | 225 | General Electric, slip ring | 440 | IM | 514 |
| 1 | 200 | Westinghouse, 3 bearing | 2200 | CCL | 600 |
| 1 | 200 | West. Elec., slip ring | 440/220 | IM | 600 |
| 2 | 170 | General Elec., synchronous | 2300 | ATI | 514 |
| 1 | 150 | Westinghouse | 220 | CS | 1200 |
| 1 | 150 | Lincoln to a 1500 g.p.m., 240 ft. head, centrifugal pump..... | 440 | IP | 1800 |
| 1 | 150 | General Elec., slip ring | 440 | M | 600 |
| 1 | 150 | General Electric | 2200/440 | L | 600 |
| 2 | 104 | General Elec., slip ring | 220 | ..... | 865 |
| 1 | 100 | Westinghouse | 220/440 | CCL | 575 |
| 1 | 100 | Westinghouse, slip ring | 220/440 | CW | 680 |
| 1 | 100 | Westinghouse, unused, slip ring | 220 | MW342 | 1160 |
| 1 | 100 | Allis-Chalmers | 440 | AN | 690 |
| 1 | 75 | Westinghouse, slip ring | 2200 | HF | 600 |
| 1 | 75 | Westinghouse | 220 | CCL | 850 |
| 1 | 75 | General Elec., unused | 440 | KT | 720 |
| 2 | 75 | General Electric | 440 | ITC5013A | 600 |
| 2 | 75 | Allis-Chalmers | 440 | AN | 865 |

## CENTRIFUGAL PUMPS

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**Motors of Every Description**
**Transformers, Turbines, Rotary Converters, Cranes, Direct Connected Units, Motor Generator Sets**

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**1—400 hp. G. E. Slip Ring Motor, 690 r.p.m., complete.**
**1—400 hp. Westinghouse Slip Ring Motor, 600 r.p.m., complete.**
**1—300 hp. Westinghouse Slip Ring Motor, 440 r.p.m.**
**1—250 hp. Allis-Chalmers Slip Ring Motor, 600 r.p.m.**
**1—200 hp. G.E. Slip Ring Motor, 600 r.p.m.**
**1—150 hp. G. E. Squirrel Cage Motor, 850 r.p.m.**
**1—150 hp. G.E. Wound Rotor Motor, 600 r.p.m.**
**2—150 hp. G.E. Slip Ring Motors, 600 r.p.m.**
**1—150 hp. Allis-Chalmers, 220 v. D.C. Motor, 700 r.p.m.**
**2—75 hp. G.E. Slip Ring Motors, 870 r.p.m.**
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**1—200 hp. Westinghouse NEW Type CW Slip Ring Motor, 3 phase, 25 cycle, 440 volt, 235 r.p.m., with new Controller and Starting Resistance. $1600, f.o.b cars Philadelphia.**

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1—15 hp. D.C. 220 volt **Roth Bros. Motor,** Cairo, Ill. ..... 75
1—Ideal 150 hp. 13x14, 265 r.p.m. **Engine,** Petersburg, Ill. ..... 250
1—50 hp. Westinghouse Industrial Type **Steam Turbine,** Canton, Ill. 250
1—York 13½ hp. **Engine** belted to Crocker Wheeler Generator, 11.6 kva., 1325 r.p.m., 125 volts, Lincoln, Ill. ..... 500
1—1½ hp. **Type KT Vertical G. E. Motor,** 220 volt, 900 r.p.m. Carbondale, Ill. ..... 60
1—75 hp. 2300 v., 20, 60 cycle, 1200 r.p.m. Squirrel Cage, **Lincoln Motor** complete with rails, pulley and starter, burned out, Canton, Ill.. 150
1—9x16x13 **Chuse Tandem Compound Engine** direct connected to Western Electric Type LSA, 550 v., 136 A. D. C. Generator with Switchboard, Mattoon, Ill. ..... 1000
1—8x13x12 same as above except as to size, Mattoon, Ill. ..... 600
1—Constant current, 2300 volt primary, 60 cycle, Sec. D.C. Amp. 4, 75 lamps, 1 circuit Westinghouse **Cooper Hewitt Mercury Rectifier Outfit,** complete with control panel and two spare rectifier tubes, Mattoon, Ill. ..... 250
1—150 hp. 14x16 250 r.p.m. **Ideal Engine,** Grand Tower, Ill. ..... 400
1—90 kw., 2300 volt, 3 phase, 60 cycle, 900 r.p.m., Type ATB **G. E. Generator** with direct connected exciter, Grand Tower, Ill. ..... 400
1—35 kva., 2300 v., 3 phase, 1200 r.p.m., 60 amp. **Type A13 Triumph Alternator** with 1.5 kw., 125 v., 1550 r.p.m., 12 amp. Type 16 F, WDG-CPD Triumph Exciter, Ullin. Ill. ..... 150
1—10 hp., 3600 r.p.m. **Buffalo Spiro Turbine,** Beardstown, Ill. ..... 150
1—16x22, 100 r.p.m. **Ames Engine** with fly wheel governor and belt wheel, Springfield, Ill. ..... 400
1—**Westinghouse Steam Turbine** 6000 r.p.m., Governor 986 r.p.m. with 375 kva., 2300 v., 94 amp. per terminal, 3 phase, 60 cycle, 700 r.p.m., A.C. Westinghouse Generator with 4 kw., 125 v., 32 amp. 900 r.p.m. Westinghouse Exciter, Springfield, Ill. ..... 4000
1—**Westinghouse Steam Turbine,** Generator and Exciter the same as above, except Generator is 900 r.p.m., Springfield, Ill. ..... 4000

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Public Service Building
SPRINGFIELD, ILLINOIS
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**All Transformers Have Necessary Oil**

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1—5 kva. G. E., 2200-v. primary, 220/110-v. secondary.
4—75 kva. Wagner 2200-v. primary, 460/230-v. secondary.
3—50 kva. Pittsburgh, 6600/5700-v. primary, have 3 taps 1.7-4.3-5 per cent, 440/220/110-v. secondary.
1—75 kva. Westinghouse, 2400-v. primary, 480/240-v. secondary.
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15—100 kva. Wagner, 2200-v. primary, 460/230-v. secondary.
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10 Buffalo Niagara No. 7 Conoidal Fans.
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1—1875 kva., Westinghouse, 3 phase, 60 cycle, 2300 volt, 3600 r.p.m., high pressure condensing.
2—1875 kva., General Electric, same as the above.
1—1250 kva., General Electric, same as the above.
1—937 kva., General Electric, same as the above.
1—937 kva., 3 phase, 60 cycle, 240 volt, mixed pressure condensing.
1—625 kva., Westinghouse, 3 phase, 60 cycle, 2400 volt, 3600 r.p.m., high pressure condensing.
1—375 kva., same as the above.
We have others.

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8—Patterson-Allen, closed water heaters. Capacity 30,000,000 B.T.U. per hour or 470 gallons per minute. Size 44-in. diameter x 10-ft. 2-in. long.
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**Turbines—Converters—Transformers**

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1—300-kw., G.E. Rotary with 6600 v. transformers.
3—200-kw. Westghse., with 6600 v. transformers.
11000/6600 v. transformers for 500 kw. Converter.
2—30 kva., Pittsburgh, 2400-240/120 v., Scott taps on low tension, transformers.
All transformers, single phase, 60 cycle, O.I.S.C.
Railway Type Converters, 600 volts D.C.
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## MOTORS
2—5-hp. Century 1800-220, 60 cy., single phase. (Good shape).
Price, Each $100.00.
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Intercourse, Pa.

**W. E. GENERATOR**
Type 19½ O.F. Kw. 3-volts full load, 120 amperes
**W. E. DYNAMO,**
Type S.N.S. 100 No. 44360, 75 Kw., 3 ph., 60 cy., 440 volts, 98.7 amperes.
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0301

## Direct Current Sets

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| 360 | Gen. Elec. | Harris Corliss |
| 312 | Gen. Elec. | Skinner Unaflow |
| 250 | Al.-Chal. | Al.-Chal. Corliss |
| 250 | Gen. Elec. | Skinner Unaflow |
| 250 | Gen. Elec. | Erie Ball, 4-valve |
| 200 | Al.-Chal. | Al.-Chal. Corliss |
| 187 | Gen. Elec. | Erie City, 4-valve |
| 150 | Al.-Chal. | Al.-Chal. Corliss |
| 125 | Gen. Elec. | Harrisburg, 4-valve |
| 125 | Gen. Elec. | Erie City, 4-valve |
| 125 | Gen. Elec. | Erie Ball, 4-valve |
| 100 | Gen. Elec. | Skinner |
| 90 | Gen. Elec. | Skinner Unaflow |
| 90 | Gen. Elec. | Ames Unaflow |
| 75 | Gen. Elec. | Skinner |
| 70 | Wghse. | Harrisburg |
| 50 | Gen. Elec. | Skinner |

## A. C. Generators

| Kva. | Make | Speed |
|---|---|---|
| 1000 (4) | Gen. Elec. | 180 |
| 560 | Gen. Elec. (3 Brg.) | 300 |
| 500 | Gen. Elec. (3 Brg.) | 360 |
| 412 | Al.-Chal. (3 Brg.) | 450 |
| 400 | Gen. Elec. (3 Brg.) | 360 |
| 360 | Wghse. (3 Brg.) | 360 |
| 300 | Gen. Elec. (3 Brg.) | 450 |
| 300 | Al.-Chal. (3 Brg.) | 600 |
| 300 | Gen. Elec. | 720 |
| 250 | Wghse. | 600 |
| 225 | Gen. Elec. | 600 |
| 200 | Wghse. | 450 |
| 200 | Gen. Elec. | 600 |
| 187 | Al.-Chal. | 600 |
| 160 | Gen. Elec. | 164 |
| 150 | Al.-Chal. | 900 |
| 150 | Wghse | 450 |
| 125 | Al.-Chal. | 900 |
| 125 | Gen. Elec. | 600 |
| 100 | Al.-Chal. | 900 |
| 75 | Gen. Elec. | 1200 |
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|---|---|---|
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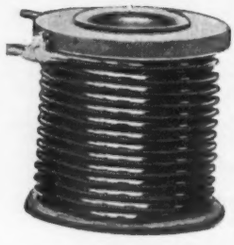
(W)



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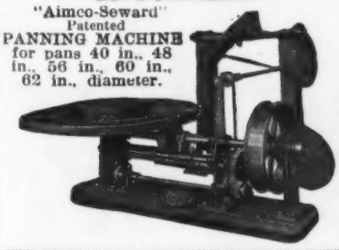

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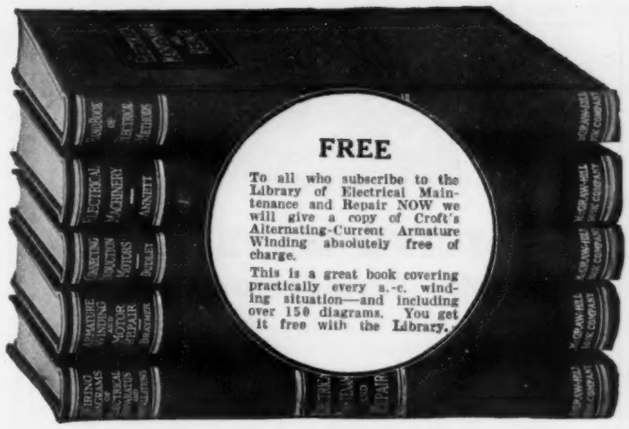
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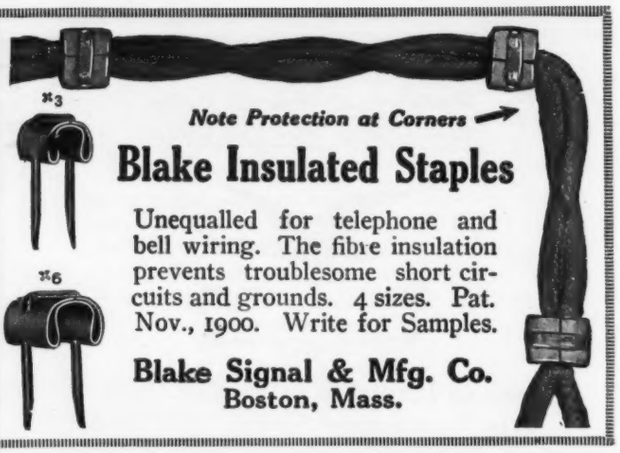


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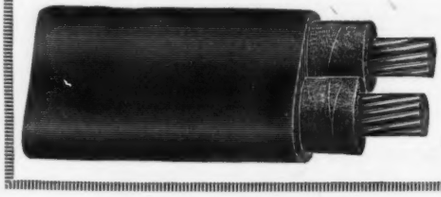

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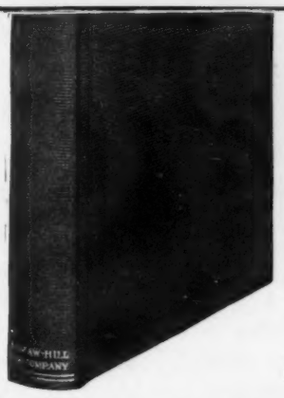

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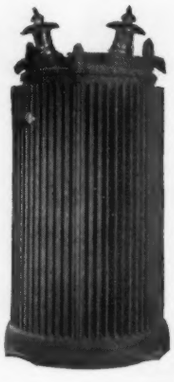

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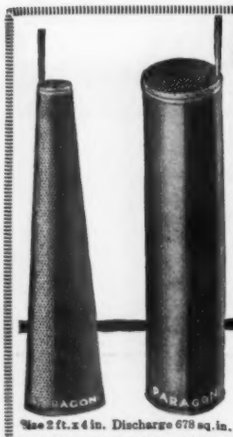


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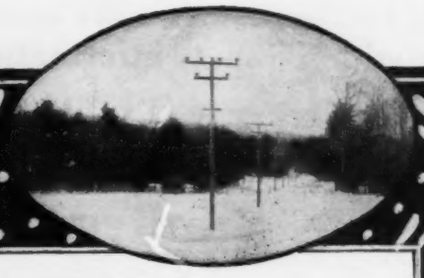

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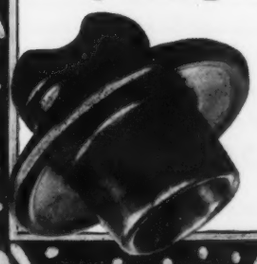

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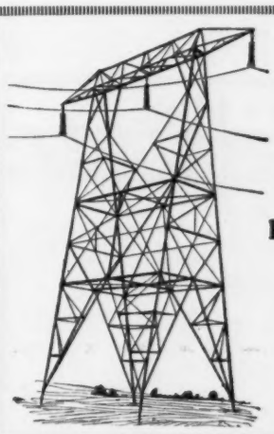

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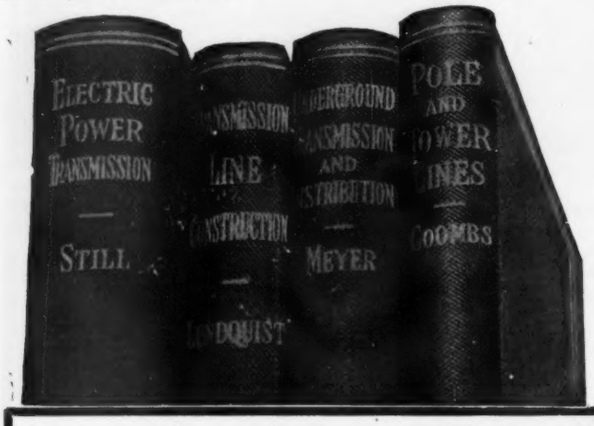


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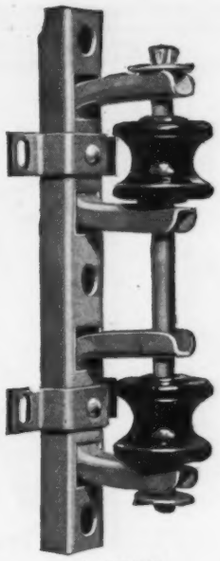

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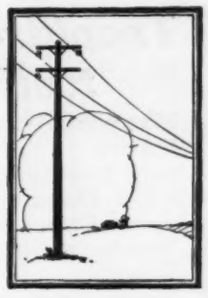

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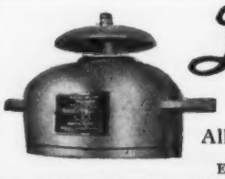

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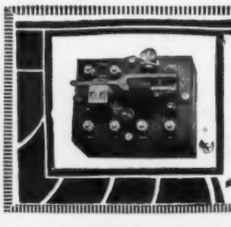

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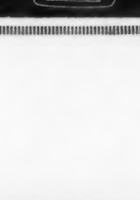

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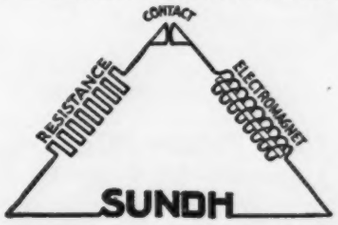


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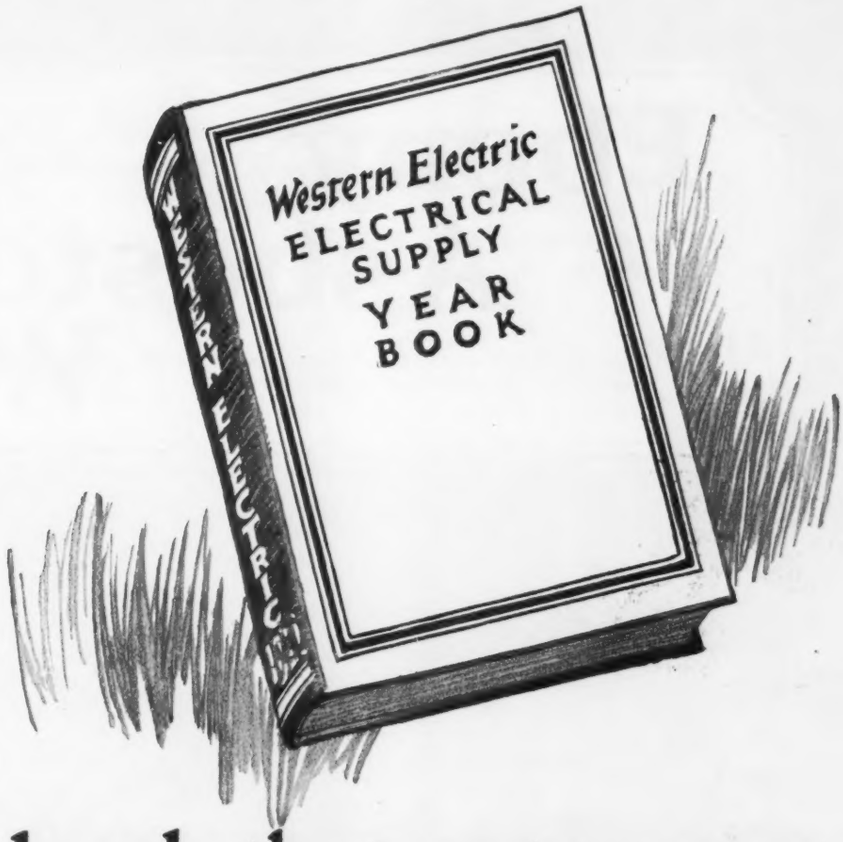


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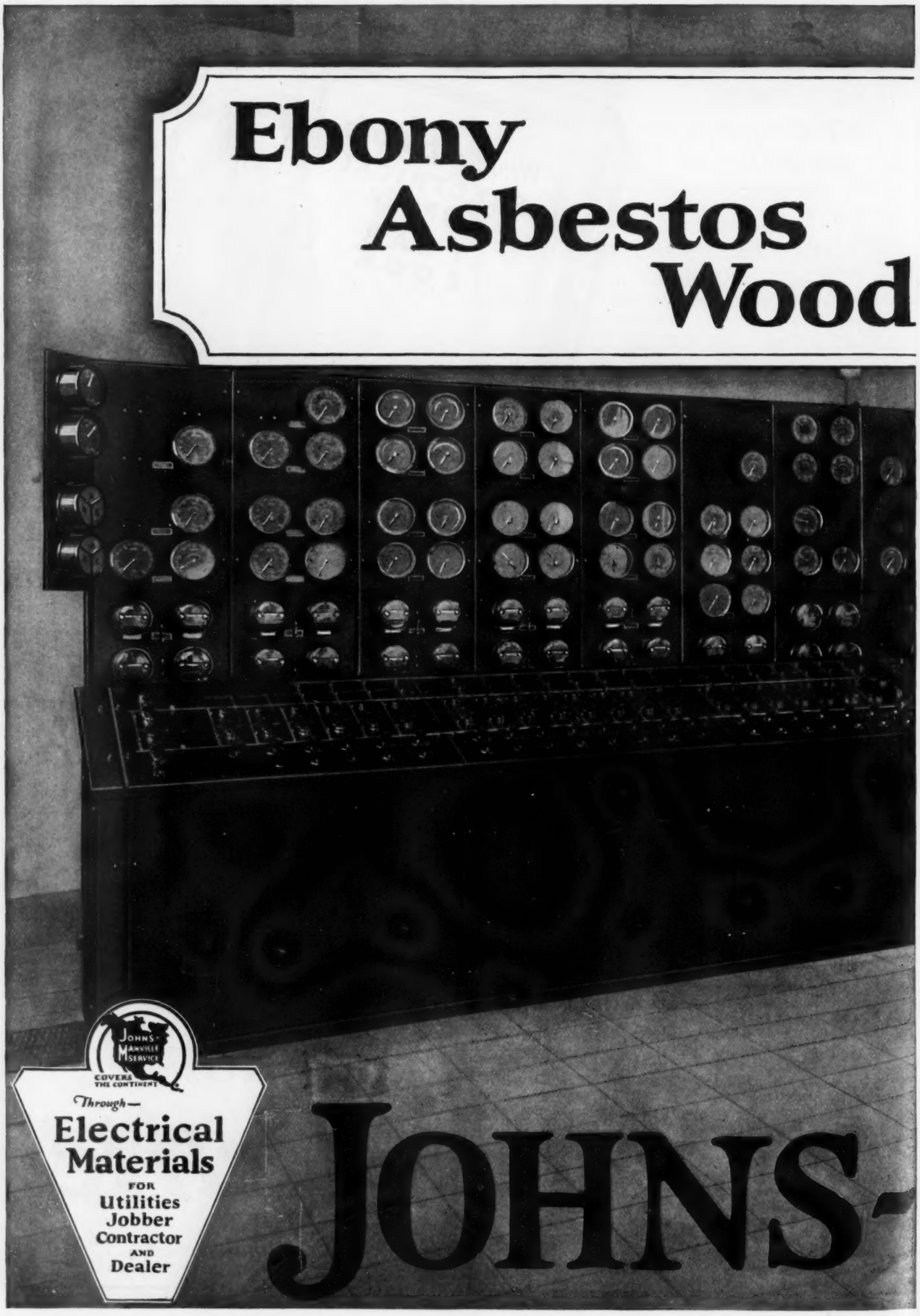
# Western Electric

**Offices in 49 Principal Cities**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THE greatest possible electrical and mechanical safety goes with the good looks of this Ebony Asbestos Wood combined Switch and Bench board, of the Bureau of Power and Light, Los Angeles, California. Ebony Asbestos Wood surpasses all other switchboard materials in dielectric strength, physical resistance and workability.

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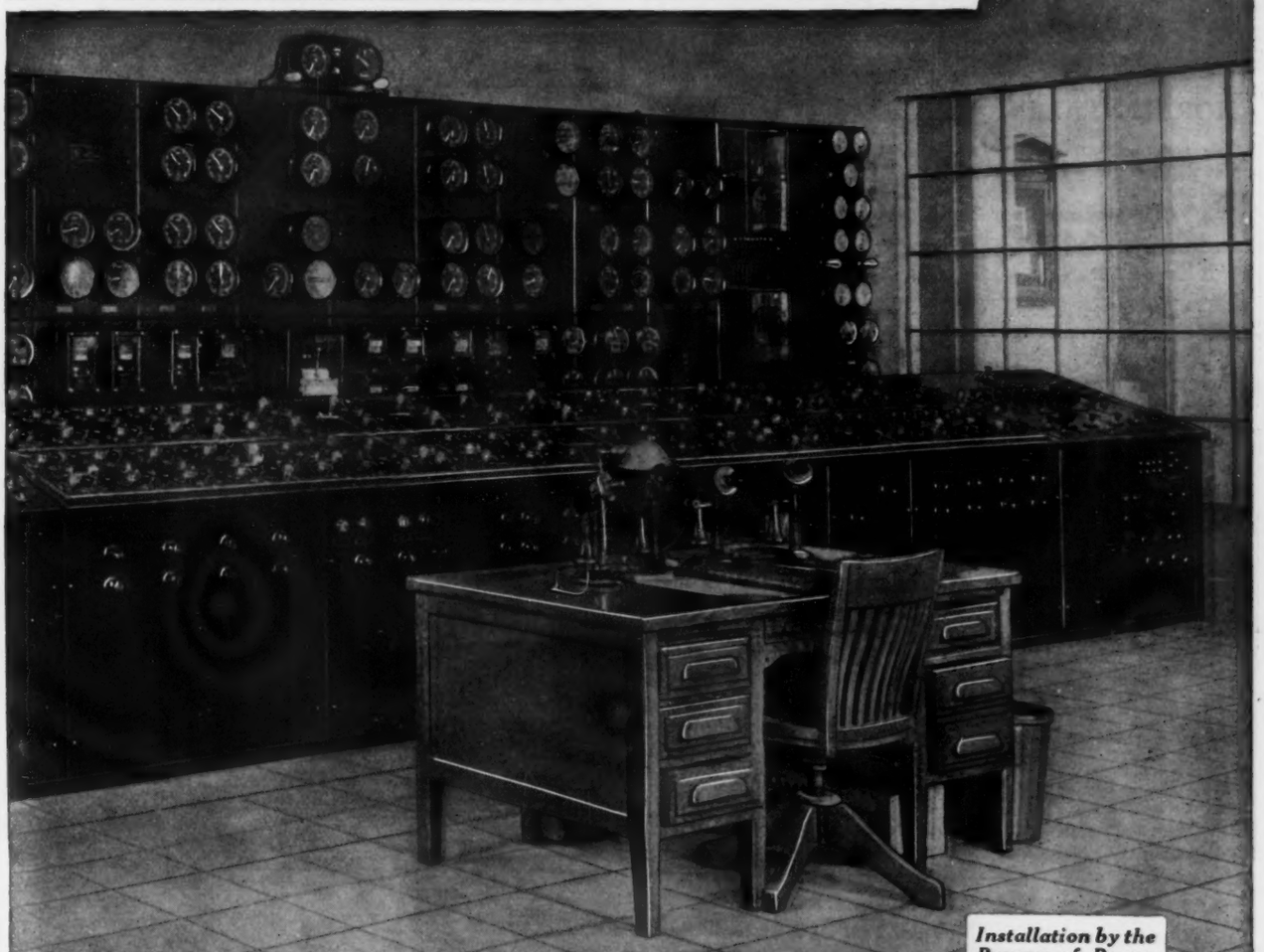

*Installation by the Bureau of Power and Light, Los Angeles, Calif.*

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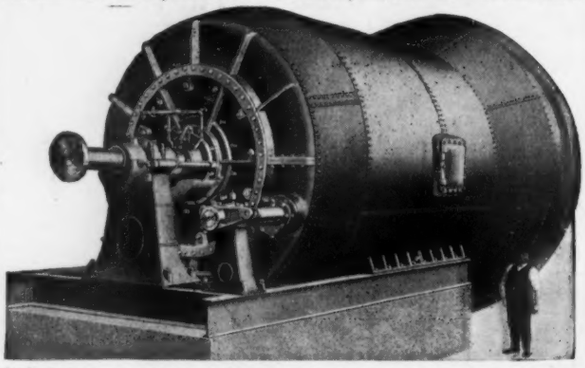
## TURBINE WATER WHEELS

HIGH SPEEDS, HIGH POWERS, HIGH EFFICIENCES



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(Curtis type)

*Use them for auxiliaries also.*

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FOR Centrifugal PUMPS

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Boiler Feed—House Service—Condensation Vacuum — Circulating — Sump (Vert.)— Sewage (Vert.)—Fire—Pneumatic System.

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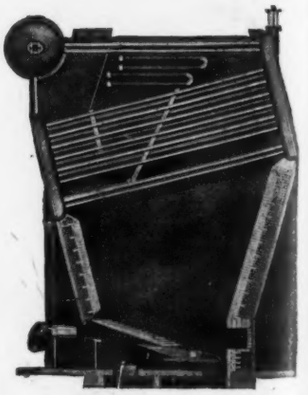
# Wickes Horizontal Cross Drum Water Tube Boiler

No wrapper sheet in header.

No riveted joint on fire side of header or buried in brickwork.

The one riveted joint in header visible at all times.



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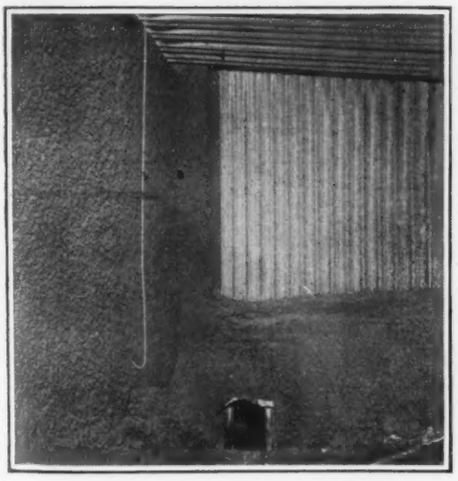
# Walls that reduce steam costs

Ordinary Furnace Wall



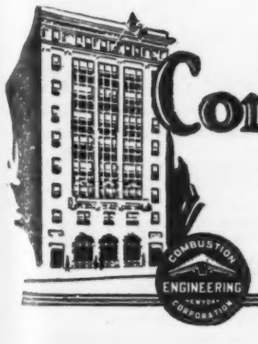
C-E Fin Furnace Wall

C-E Fin Furnace walls replace furnace wall maintenance charges with steam producing walls.

C-E Fin Furnace walls are composed of water tubes connected in the boiler circulation.

Evaporation is increased and efficiency improved.

Burning and spalling of furnace walls is eliminated.

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**Combustion Engineering Corporation**

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Green Pressure Waterbacks
Quinn Fuel Oil Equipment
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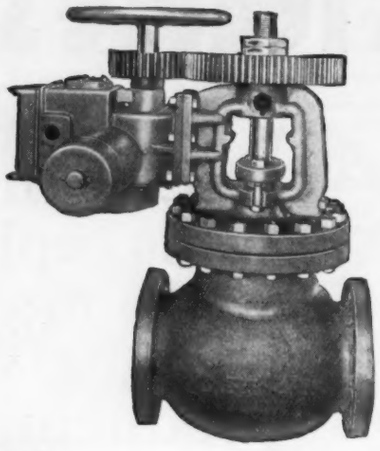
FOR THE ELECTRICAL OPERATION OF ALL MAKES AND SIZES OF VALVES



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ANY ELECTRICAL CIRCUIT.

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improve engine, turbine and boiler economy by enabling a given amount of steam to do more work. Over 10,000 installations in stationary power plants.

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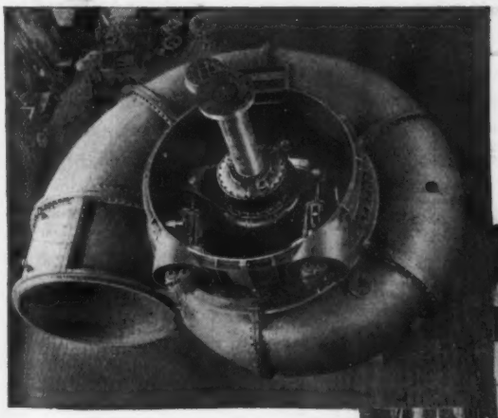
## *Happy New Year*

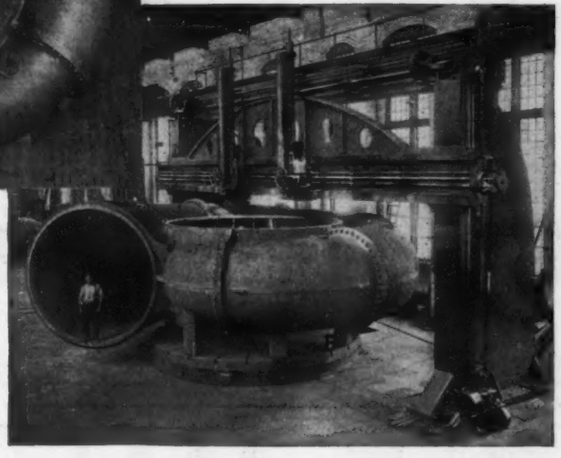
At this season of the year we wish to acknowledge our appreciation of what the electrical industry has contributed toward our success.

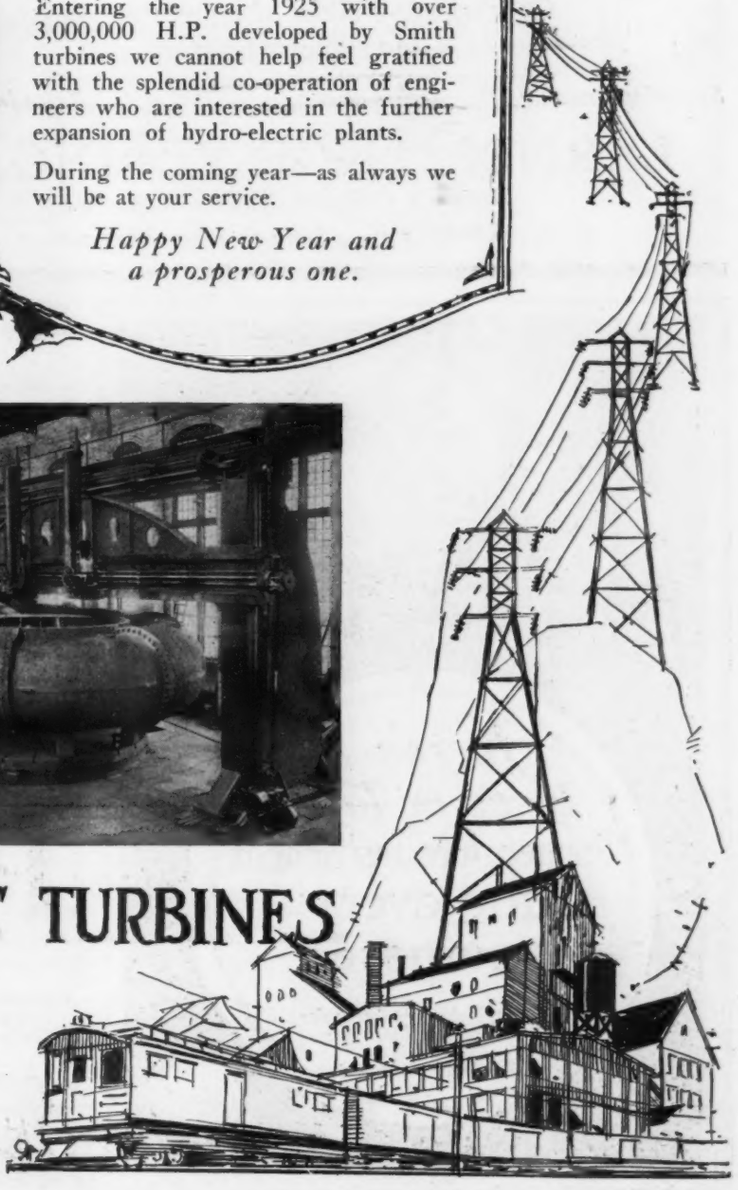
Entering the year 1925 with over 3,000,000 H.P. developed by Smith turbines we cannot help feel gratified with the splendid co-operation of engineers who are interested in the further expansion of hydro-electric plants.

During the coming year—as always we will be at your service.

*Happy New Year and a prosperous one.*







# SMITH HYDRAULIC TURBINES

S. Morgan Smith Co.
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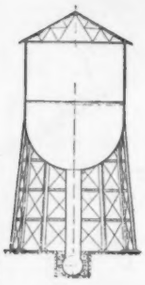
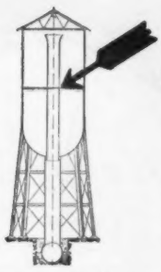
# The JOHNSON DIFFERENTIAL SURGE TANK
## *for Water Power Plants*



Simple Tank



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**Internal Riser**

produces differential action which effects an important saving in size of tank.

Twenty-seven Differential Tanks in operation or under construction.

Comparative sizes of equivalent tanks for same regulation

*Superior Pressure Regulation at Minimum Expense. Write for full details.*

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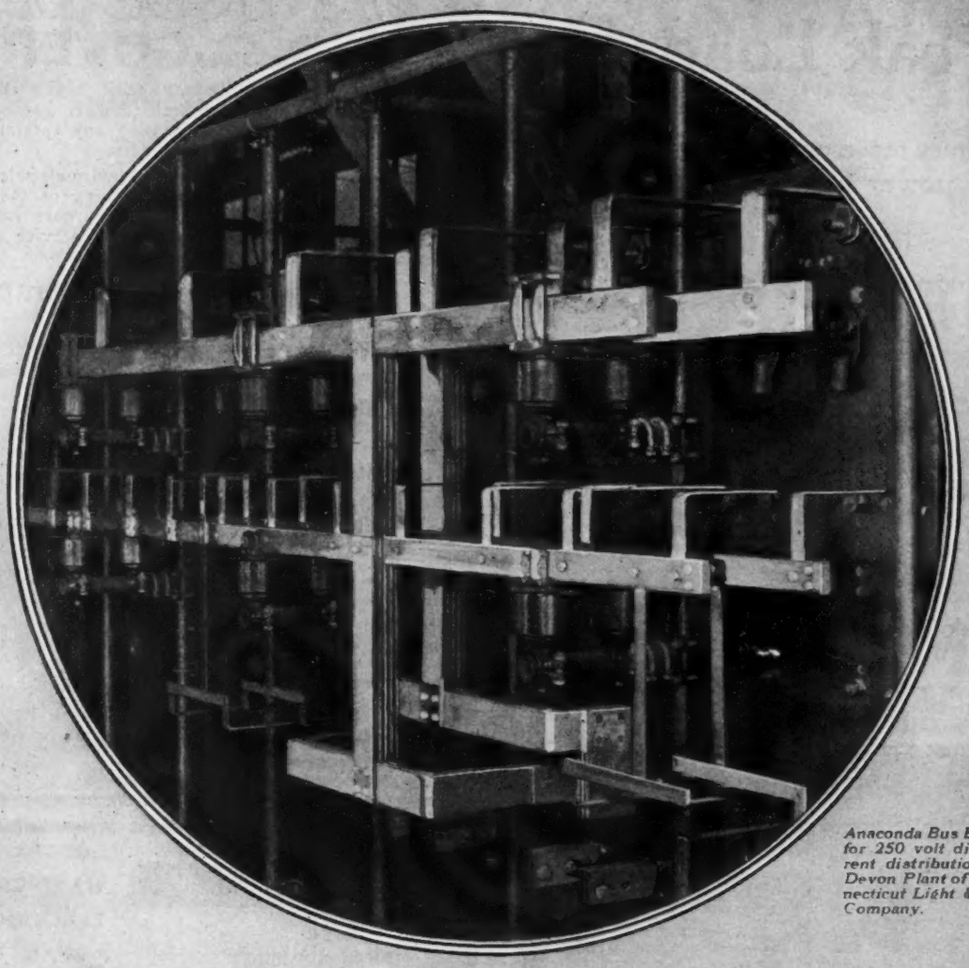

*Anaconda Bus Bars used for 250 volt direct current distribution panel, Devon Plant of the Connecticut Light & Power Company.*

# Anaconda Bus Bar Copper

The accurate dimensions and perfectly flat contact surfaces of Anaconda Bus Bars are the result of The American Brass Company's practice of finishing all Bus Bars hard through dies. The degree of hardness is carefully controlled so that Anaconda bars are easy to bend but will retain the required position.

Anaconda mined and refined copper assures conductivity in excess of 99.9% at 20° C. in terms of International Annealed Copper Standard.

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# Peak Loads

Sometimes represent a larger portion of the power bill than the energy used.

Power costs are being cut by running

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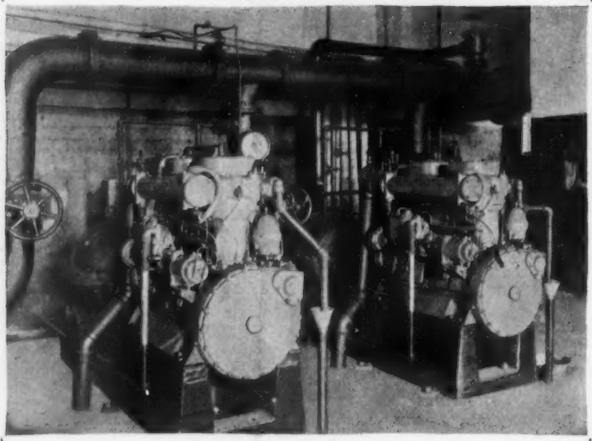
THE ENGINE OF REFINEMENT

for peak loads. And for emergency.



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**12 to 250 B. H. P. load, 750 to 1500 revs., $20 a H.P.**

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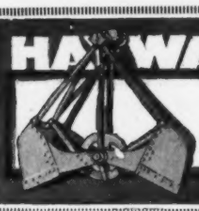
HAYWARD BUCKETS



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Executives, Engineering and Sales Department,
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Unite in thanking you for the measure of
Prosperity accorded them during the past year
and in wishing you

*Prosperity and Happiness*

for the year of Nineteen Twenty-five

**RIDGWAY DYNAMO & ENGINE CO.**
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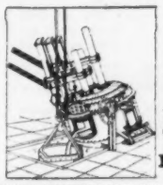
*will*
**Build Power Business**
*for*
**THE CENTRAL STATION**
*Let us help increase your revenue*
**Detroit Electric Furnace Co.**
645 BOOK BLDG., DETROIT



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Ten Standard Sizes ½ to 24 Tons Capacity
Most Rapid and efficient for making
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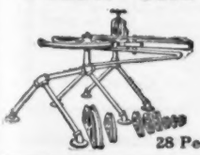

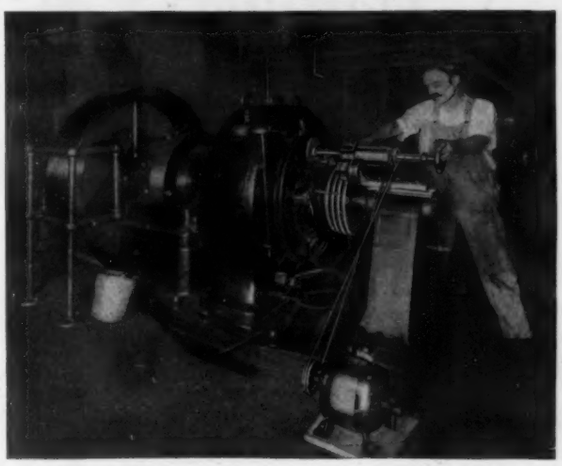

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THE JORDAN COMMUTATOR TRUING DEVICE is a standard equipment for truing commutators or collector rings and should be kept in every electric plant, power house, mill or factory where generators or motors are in use. Thousands of satisfied users.

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# Garmnay

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If a Tibetian cannot start his journey on Thursday, he sends ahead some of his baggage—just to fool the fates into believing that he's on his way.

This he calls garmnay.

Something like cheating at solitaire.

Or like defending a misapplication of carbon brushes and trying to show that they work by slopping on lubricant—when your better nature calls out for Morganite.

**Morganite Brush Co., Inc.**

*Main Office and Factory,*
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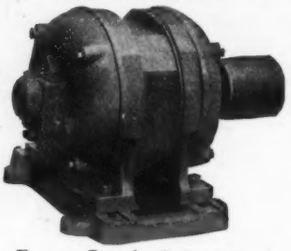
L. A. Motors



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*Every L. A. Salesman is an Application Engineer*

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**MILWAUKEE**

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(Interchangeable)
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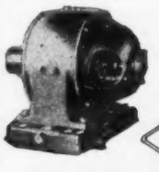
*We sell no motors at retail or to the user*



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**A. C. Machines up to 30 HP. All standard speeds and voltages. Get Bulletin No. 300.**

*Special machines built to meet your needs. Full details cheerfully supplied. Write*

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Gladstone, Mich.

**IMPERIAL**

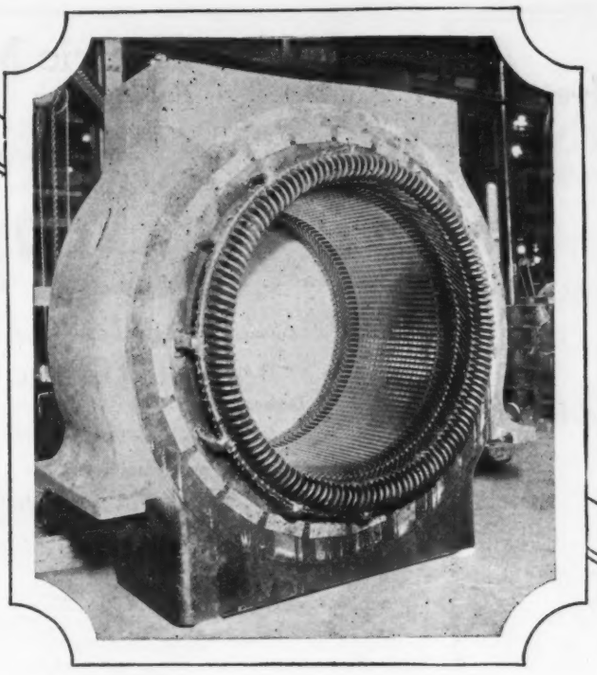
**MOTORS** **GENERATORS**

**Imperial Electric Co.** **Akron, Ohio**

**ZOBELL ELECTRIC MOTORS**

Superior 1 to 5 H.P. motors, D.C. or A.C., built on a sectionalized plan. Can be used for special applications without excessive developing cost. *Write for Bulletin.*

**Zobell Electric Motor Corp., Garwood, N. J.**



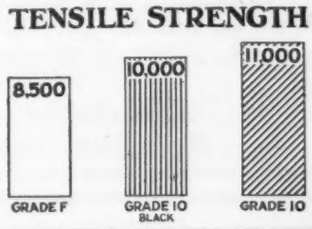
In the manufacture of large generating machinery, like the stator illustrated Celoron is used in many places because of its high diaelectric qualities.

Where unusual insulation is necessary

# Think of CELORON on the basis of The "BIG FOUR" of Insulation

**TENSILE STRENGTH**

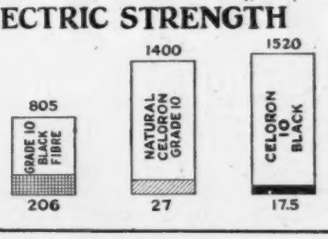
Lbs. per Sq. In.




**DIELECTRIC STRENGTH**

Average Volts per mils

Average Thickness in mils




**WORKABILITY**

| | | |
|---|---|---|
| Bend | Punch | Thread |
| Twist | Shave | Engrave |
| Saw | Shear | Plane |
| Drill | Turn | Ream |
| | Mill | |

**ADAPTABILITY**

For every insulation application where unusual insulation is necessary.

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## DIAMOND STATE FIBRE COMPANY

Bridgeport (*near Philadelphia*) Pa., and Chicago, Ill.

*Makers of*

**Diamond-Fibre-Celoron-Vulcawood**

You're having brush trouble

CORRECT IT

USE LE CARBONE CARBON BRUSHES

They talk for themselves

COST MORE PER BRUSH
COST LESS PER KW.H.

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**Baldor Electric Motors**
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Single Phase Repulsion Type
Direct Current
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Horizontal and Vertical Design.
Semi and Totally Enclosed Back Geared

*Superior in Quality. Competitive in Price.*

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MORSE CHAIN CO., ITHACA, N. Y.
*Consult the Morse Engineer in your territory

Over 3,500,000 hp. in use for transmitting power under all conditions of service in all industries.

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**O-Z Hand Tachometers**
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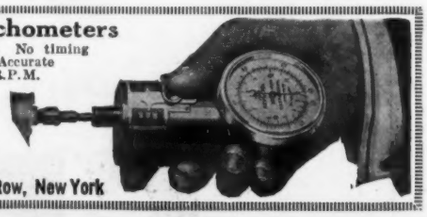
"Dead Beat" Accurate
30-24,000 R.P.M.



**Hand Tachograph**
Draws graphic charts of speeds.
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CORRECTION of POWER FACTOR
ON THE INDIVIDUAL MOTOR
can now be successfully made with the National Electric Condenser—which can be mounted anywhere, in any position. *Catalog sent to Engineers on request.*
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One of the Segur Coil Making Tools that is helping large users of motors to keep their maintenance costs down to bed rock. The Segur Coil Winding Machine is simplicity itself regardless of the type of coil it is called upon to wind. Send for Segur data sheets.
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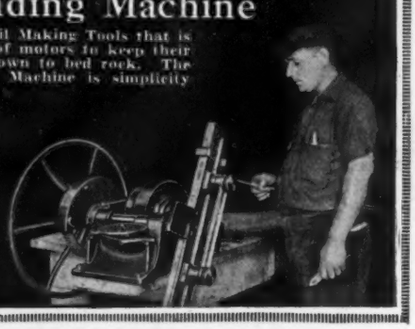

**Sturtevant Electric Motors**
Direct and Alternating Current
Single and Polyphase
Generators and Generating Sets
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Hyde Park, Boston, Mass.

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Brass, Steel and Copper Washers.
Flat, Bevelled or Countersunk.
Special Sizes and Shapes.
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WHY BUY ADVERTISING SPACE in 10 or more different trade publications when ONE magazine now reaches ALL retailers and wholesalers of radio sets and accessories?

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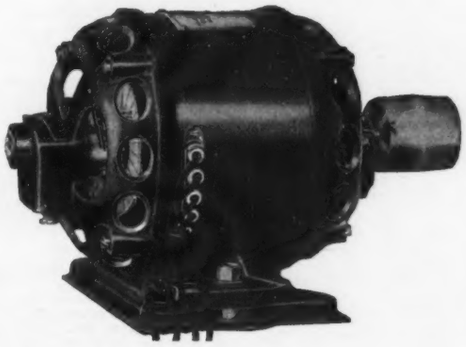
**Repulsion Start Induction Fractional Horsepower, SINGLE PHASE MOTORS**

are exceedingly quiet in operation. This is a very necessary feature when used in the home for such drives as house pumps, household refrigerating machines, oil burners, etc.

Their fitness for this class of drive has been proven by their adoption as regular equipment by many of the leading manufacturers of such apparatus.

**Built in sizes from ⅛ to 40 Horsepower**

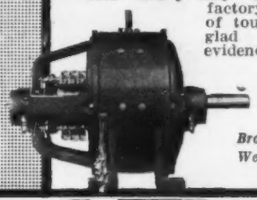


The ¼ Hp. Motor

**CENTURY ELECTRIC COMPANY**

General Offices: 1827 PINE ST.
ST. LOUIS, MO., U. S. A.

Type T Reliance Motors have earned the title "heavy duty" by eight years of satisfactory service on all kinds of tough jobs. We shall be glad to submit complete evidence.



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Cleveland, O.

*Branches in Principal Cities.*
*We build both D.C. and A.C. motors.*

Type T Heavy Duty RELIANCE MOTORS
Direct Current

All Leading "Stop" "Go" Signals use RECO FLASHERS

They operate 90% of the electric signs. Absolutely reliable.

REYNOLDS ELECTRIC COMPANY
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*Makers also of Reco Mixers, Color Hoods, Motors, etc.*

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Ball Bearing Motors

Direct and Alternating Current up to 75 hp. Also generators and alternators in horizontal and vertical types, and motor generater sets. We build motors to meet your requirements. *Ask for more data.*

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Give Your Product

Power to start heavy overloads

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Power to operate on low voltage

And This Means:

Lower service costs and greater net profits for you and your dealers.

Write for the complete Master Story.

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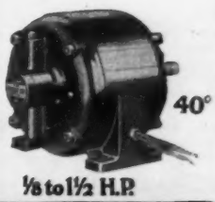


⅛ to 1½ H.P.

Power

# WHAT AND WHERE TO BUY

## Equipment, Apparatus and Supplies Advertised in This Issue with Names of Manufacturers and Distributors

Readers interested in any articles not listed in these pages are cordially invited to inform us of their wants and every effort will be made to put them in touch with the proper manufacturers.

Readers' Service Department
ELECTRICAL WORLD, Tenth Avenue and 36th Street, New York

**Air Compressors**
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. Mfg Co.

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Combustion Eng. Corp.
Prat-Daniel Corp.

**Air Washing & Conditioning Apparatus**
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Reed Air Filter Co.
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Matthews Corp., W. N.

**Armature Repair Machinery**
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**Asbestos**
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*Ebony Wood*
Johns-Manville, Inc.
*Niagrite Cable Protection*
Johns-Manville, Inc.
*Paper Tape*
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*Transite Wood*
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Westinghouse Elec. & Mfg. Co.

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Western Electric Co.

**Battery Charging Apparatus**
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General Electric Co.
Ward Leonard Elec. Co.
Westinghouse Electric & Mfg. Co.

**Bearings, Ball**
Fafnir Bearing Co.
S. K. F. Industries

**Blocks, Fuse**
Westinghouse Elec. & Mfg. Co.

**Blowers**
Allis Co., Louis
American Blower Co.
Sturtevant Co., B. F.
*Induced Draft*
Prat-Daniel Corp.

**Blowers, Steam Driven**
De Laval Steam Turbine Co.
Terry Steam Turbine Co.

**Boiler Feed Distilling Plants**
Griscom-Russell Co.

**Boiler Room Instruments (See Instruments)**

**Boilers**
*Water Tube*
Babcock & Wilcox Co.

**Bond Testers**
Roller-Smith Co.

**Books, Technical**
McGraw-Hill Book Co., Inc.

**Boosters**
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

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G & W Elec. Spec. Co.
General Electric Co.
Metropolitan Devices Co.
Schweitzer & Conrad, Inc.
*Junction and Outlet*
Chicago Fuse Mfg. Co.
G & W Elec. Spec. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.
*Meter and Service*
General Electric Co.
Metropolitan Device Corp.
*Subway*
Johns-Pratt Co.
*Switch*
Johns-Pratt Co.

**Brackets and Pins, Metal**
Line Material Co.
Pittsburgh Transformer Co.

**Brushes, Dynamo & Carbon**
Jeandron, W. J.
Morganite Brush Co.

**Buckets, Clamshell, Excavating and Grab**
Hayward Co.

**Buildings**
*Steel*
Delta-Star Electric Co.
Milliken Bros. Mfg. Co.

**Bus Bars**
*Copper*
American Brass Co.

**Bus Bar Supports**
Delta-Star Electric Co.
Electric Power Equip. Corp.
Electrical Development & Mach. Co.
General Electric Co.
Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

**Cable (See Wires & Cables)**

**Cable Machinery**
American Ins. Machy. Co.

**Cable Racks, End Bells and Accessories**
Elec. Engineers Equip. Co.
G & W Elec. Spec. Co.
Metropolitan Devices Co.
Standard Underground Cable Co.

**Cable Splicing Joints**
Matthews Corp., W. N.

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Driver-Harris Co.

**Cement**
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Johns-Manville, Inc.
*Insulator*
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**Chains**
*Silent Power Transmission*
Morse Chain Co.

**Circuit Breakers**
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General Electric Co.
Roller-Smith Co.
Sangamo Electric Co.
Schweitzer & Conrad, Inc.
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**Clamps**
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Sherman Mfg. Co., H. B.
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*Guy*
Matthews Corp., W. N.
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Ohio Brass Co.

**Cleats**
Blake Signal & Mfg. Co.
Electrical Development & Mach. Co.
Imperial Porcelain Wks.
Thomas & Sons Co., R.

**Clutches, Magnetic**
Cutler-Hammer Mfg. Co.

**Coal and Ash Handling Machinery**
Combustion Engineering Corp.
Hayward Co.

**Coil Winding Tools**
Electric Service Supplies

**Coils, Armature, Field and Magnet**
Belden Mfg. Co.
Dudlo Mfg. Co.
General Electric Co.

**Coils, Choke**
Delta-Star Electric Co.
General Electric Co.
Hi-Voltage Equip. Co.
Railway & Industrial Eng. Co.
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**Commutators**
Cameron Elec. Mfg. Co.

**Commutator Truing Devices**
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**Condensation Products**
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Condensite Co. of Amer.
General Bakelite Co.
Redmanol Chem. Prod. Co.

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Westinghouse Elec. & Mfg. Co.
Wireless Spec. App. Co.
*Steam*
Allis-Chalmers Mfg. Co.
General Electric Co.

**Condensers, Rotary Jet**
Manistee Iron Works

**Conduit Fittings**
Chicago Fuse Mfg. Co.

**Conduit**
*Fibre*
Fibre Conduit Co.
Johns-Manville, Inc.
*Interior*
American Circular Loom Company
Fibre Conduit Co.
Johns-Manville, Inc.
*Underground*
Johns-Manville, Inc.

**Connectors**
Western Electric Co.

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General Electric Co.
Sherman Mfg. Co., H. B.
Westinghouse Elec. & Mfg. Co.

**Construction Engineering (See Directory of Engineers)**

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Electric Service Supplies Co
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Westinghouse Elec. & Mfg. Co.

**Controllers**
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Cutler-Hammer Mfg. Co.
Ward Leonard Electric Co.
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Sundh Electric Co.
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*Synchronous*
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*Trolley*
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**Cranes**
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Universal Crane Co.
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Sterling Engine Co.
*Oil*
Ingersoll-Rand Co.
Lombard Governor Co.
Sterling Engine Co.
*Steam*
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Sturtevant Co., B. F.
*Unaflow*
Ridgway Dynamo & Eng. Co.

**Evaporators**
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**Excavating Machinery, Motor Driven**
Hayward Co.

**Experimental Apparatus**
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Diehl Mfg. Co.
General Electric Co.
Western Electric Co.
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American Blower Co.
Century Electric Co.
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Sturtevant Co., B. F.
Westinghouse Elec. & Mfg. Co.
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**Fibre (See Insulating Material)**

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Detroit Electric Furnace Co
Pittsburgh Elec. Furnaces Corp.
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American Bridge Co.
*Pulverized Fuel*
Combustion Engr. Co.

**Fuse Plugs**
Delta-Star Electric Co

**Fuses**
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Johns-Pratt Co.
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Johns-Pratt Co.
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Elec. Engineers Equip. Co
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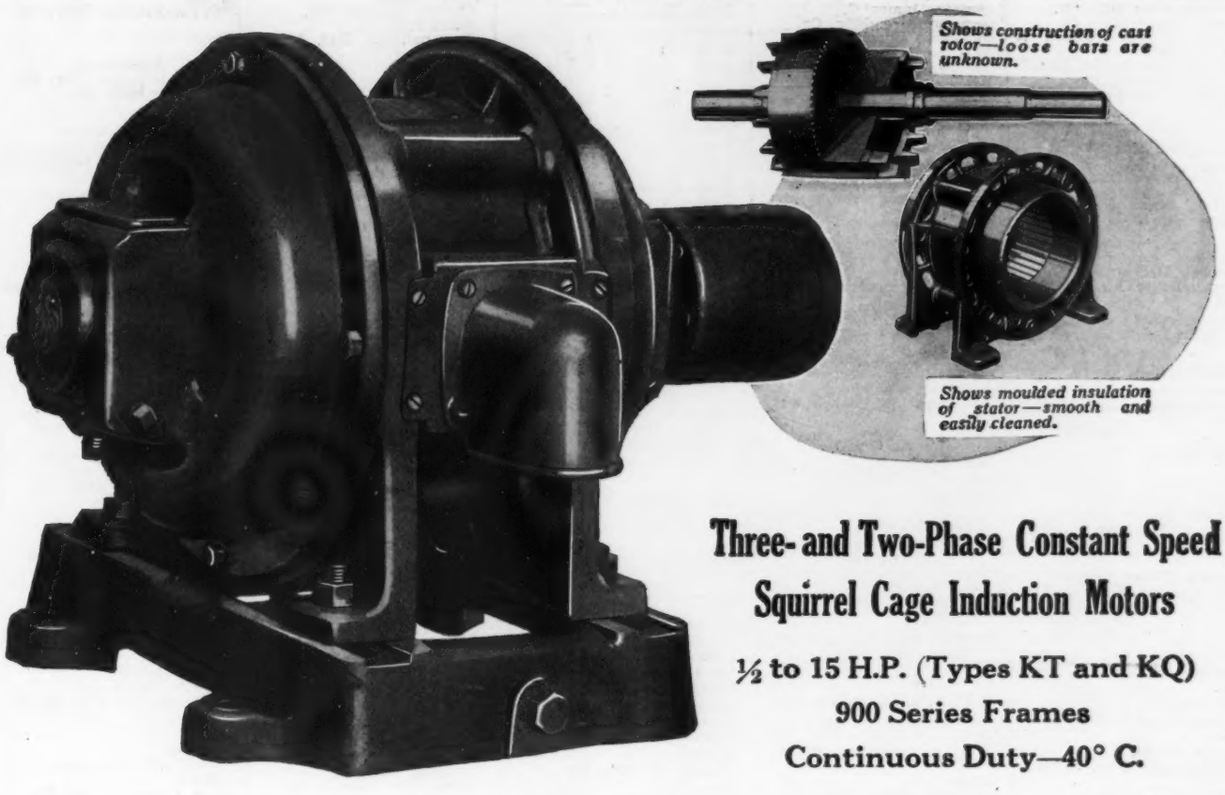


# Three- and Two-Phase Constant Speed Squirrel Cage Induction Motors

**½ to 15 H.P. (Types KT and KQ)**
**900 Series Frames**
**Continuous Duty—40° C.**

To build motors that meet users' needs and to render service that insures satisfaction to the purchaser is the constant aim of the General Electric Company. Excellent mechanical and electrical construction in the new "900 series" motors insure exceptional operating characteristics.

Outstanding features of the "900 Series" are:

### Electrical—

Ample starting torque and rapid acceleration.
Maximum pullout torque over 250% of full load torque.
Less than 6% slip.
Temperature rise at full load will not exceed 40° C.

### Mechanical—

Large dustproof oil wells—frequent replenishment unnecessary.
Sliding base, easily mounted on wall, floor or ceiling—permits quick change of belt tension without affecting alignment.
Large conduit terminal box—facilitates making connections.
Paper pulley transmits full power at low belt tension.
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The new 900 series motor does its work well, requires little attention, has a low maintenance cost, and uses power efficiently—just what every user wants.

**General Electric engineers study the power requirements of all industries. Through adequate manufacturing facilities, their efforts result in a combination of motors and control closely adapted to the service to be performed.**

**General Electric Company**
**Schenectady, N. Y.**
**Sales Offices and Motor Dealers in All Large Cities**

45-246

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Condit Elec'l Mfg. Co.
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Metropolitan Device Corp.
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Cattie & Bros., J. P.

**Gearing, Silent Flexible**
Morse Chain Co.

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Westinghouse Elec. & Mfg. Co.
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General Electric Co.
Ridgway Dynamo & Eng. Co.
Sturtevant Co., B. F.
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*Engine Driven*
Westinghouse Elec. & Mfg. Co.
*Waterwheel Driven*
Westinghouse Elec. & Mfg. Co.

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Sturtevant Co., B. F.

**Grounds, Etc.**
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Power Specialty Co.

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**Indicators, Transformer Load**
Westinghouse Elec. & Mfg. Co.

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Roller-Smith Co.

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Sangamo Electric Co.
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*Integrating*
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*Cement*
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Diamond State Fibre Co.
General Bakelite Co.
Redmanol Chem. Prod. Co.
*Lava*
American Lava Co.
Kirchberger Co., M.
Steward Mfg. Co., D. M.
*Mica*
Mica Insulator Co.
Munsell & Co., Eugene
*Mica, Micarata*
Westinghouse Elec. & Mfg. Co.
*Molded*
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Condensite Co. of Amer.
Cutler-Hammer Mfg. Co.
Garfield Mfg. Co.
General Bakelite Corp.
Johns-Manville, Inc.
Redmanol Chem. Prod. Co.
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Diamond State Fibre Co.
Irvington Varnish & Ins. Co.
*Silk*
Irvington Varnish & Ins. Co.
Kyle & Co., Wm.
*Slate*
Portland-Monson Slate Co.
*Tape and Webbing*
General Electric Co.
Mica Insulator Co.
Okonite Co., The
Packard Electric Co.
Westinghouse Elec. & Mfg. Co.
*Treated Fabric and Paper*
Westinghouse Elec. & Mfg. Co.
*Untreated Fabric and Paper*
Westinghouse Elec. & Mfg. Co.
*Wax Paper*
Candy Company, Inc.

**Insulation, Electric**
Bakelite Corp.
Condensite Co. of Amer.
General Bakelite Co.
Redmanol Chem. Prod. Co.
West Virginia Pulp & Paper Co.

**Insulator Equipment**
Erie Elec'l Equip. Co.
Ohio Brass Co.
Thomas & Sons Co., R.

**Insulator Tester**
Doble Engr. Co.

**Insulators**
*Glass*
Hemingray Glass Co.
Lapp Insulator Co., Inc.
Locke Ins. Corp.
*Porcelain Composition*
Franklin Porcelain Co.
General Insulate Co.
Imperial Porcelain Works
Lapp Insulator Co., Inc.
Locke Ins. Corp.
Ohio Brass Co.
Thomas & Sons Co., R.
Westinghouse Elec. & Mfg. Co.
*Post Type*
Delta-Star Electric Co.
Electrical Development & Mach. Co.

**Irons, Electric**
Westinghouse Elec. & Mfg. Co.

**Laminated, Phenolic Condensation Products**
Westinghouse Elec. & Mfg. Co.

**Lamp Guards**
Matthews Corp., W. N.

**Lamp Replacers**
Matthews Corp., W. N.

**Lamps**
*Arc*
General Electric Co.
Westinghouse Elec. & Mfg. Co.
*Cable Supporting*
Matthews Corp., W. N.
*Incandescent*
General Electric Co.
Western Electric Co.
*Miniature*
General Electric Co.

**Lighting Equipment, Interior and Exterior**
Westinghouse Elec. & Mfg. Co.

**Lightning Arresters**
Delta-Star Elec. Co.
Electric Power Equip. Corp.
Electrical Engineers Equip. Co.
Electric Service Supplies Co.
General Electric Co.
Hi-Voltage Equipment Co.
Railway & Indus. Engr. Co.
Schweitzer & Conrad, Inc.
Shaw, Henry M.
Westinghouse Elec. & Mfg. Co.

**Line Material**
Anderson Mfg. Co., A. & J. M.
Archbold-Brady Co.
Electric Service Supplies Co.
G & W Elec. Spec. Co.
General Electric Co.
Line Material Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.

**Locomotives, Electric**
Westinghouse Elec. & Mfg. Co.

**Lubricants**
Waverly Oil Co.

**Lugs**
Sherman Mfg. Co., H. B.

**Machines**
*Hoisting*
American Bridge Co.
*Pipe Bending*
Am. Pipe Bending Machine Co.

**Magnets**
Dudlo Mfg. Co.
Elec. Controller & Mfg. Co.

**Manganin**
Baker & Co., Inc.

**Meters**
*Demand*
Westinghouse Elec. & Mfg. Co.
*Kilovoltamperes*
Westinghouse Elec. & Mfg. Co.

**Meter Testers**
General Electric Co.
Johns-Pratt Co.
Westinghouse Elec. & Mfg. Co.

**Meters, Electric & Flow (See Instruments, Electric & Boiler Room)**

**Mica**
Mica Insulator Co.

**Mining Machinery**
Allis-Chalmers Mfg. Co.

**Molded Insulation (See Insulation, Molded)**

**Molding Materials**
Bakelite Corp.
Condensite Co. of Amer.
General Bakelite Co.
Redmanol Chem. Prod. Co.

**Motor Generators**
Westinghouse Elec. & Mfg. Co.

**Motor Generator Sets**
Ridgway Dynamo & Eng. Co.

**Motors**
Allis Co., Louis
Allis-Chalmers Mfg. Co.
Baldor Electric Co.
Burke Elec. Co.
Century Electric Co.
Diehl Mfg. Co.
Emerson Electric Mfg. Co.
General Electric Co.
Gregory Electric Co.
Imperial Elec. Co.
Jeannin Electric Co.
Master Electric Co.
Reliance Elec. & Eng. Co.
Star Elec. Motor Co.
Sturtevant Co. B. F.
Triumph Electric Co.
Zobell Elec. Motors Co.
*Mine*
Westinghouse Elec. & Mfg. Co.
*Railway*
Westinghouse Elec. & Mfg. Co.
*Small*
Reynolds Electric Co.
Westinghouse Elec. & Mfg. Co.

**Oil Burning Systems**
Combustion Engr. Corp.

**Oil Coolers**
Griscom-Russell Co.

**Oil Engines (See Engines)**

**Oil Heaters**
Griscom-Russell Co.
Power Spec. Co.

**Oil Pressure Governors**
Lombard Governor Co.

**Oil and Grease Lubricating**
Waverly Oil Co.

**Packing**
General Electric Co.
*Asbestos*
Johns-Manville, Inc.

**Panel Boards**
General Electric Co.
Johns-Manville, Inc.
Westinghouse Elec. & Mfg. Co.

**Panels, Switchboard**
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

**Penstocks**
Pelton Water Wheel Co.

**Pipe Frame Fittings, Electrical**
Schweitzer & Conrad, Inc.

**Pipe**
*Riveted Steel*
Riter-Conley Co.

**Platinum**
Baker & Co., Inc.

**Plugs**
Cutler-Hammer Mfg. Co.

**Plugs, Attachment**
Cutler-Hammer Mfg. Co.
General Elec. Co.

**Pole Line Hardware**
Bethlehem Steel Co.
Electric Service Supplies Co.
Ohio Brass Co.

**Poles**
*Cedar*
Bell Lumber Co.
National Pole Co.
Naugle Pole & Tie Co.
Northern Pole & Lumber Co.
Partridge Lumber Co., T. M.
Seguin, J. J.
Western Electric Co.
*Iron*
Archbold-Brady Co.
*Southern Pine*
Texas Creosoting Co.
*Steel*
Bates Exp. Steel Truss Co.
Milliken Bros. Mfg. Co.
Pacific Coast Steel Co.
Riter-Conley Co.
Truscon Steel Co.

**Porcelain (See Insulating Material, China and Porcelain)**

**Posts, Wood**
Naugle Pole & Tie Co.

**Potentiometers**
Biddle, James G.
Westinghouse Elec. & Mfg. Co.

**Potheads**
Electrical Development & Mach. Co.
G & W Elec. Spec. Co.

**Preheaters, Air**
Prat-Daniel Corp.

**Projectors, Floodlighting**
Electric Service Supplies Co.

**Protective Devices**
Condit Elec'l Mfg. Co.
Electric Power Equip. Corp.
General Electric Co.
Metropolitan Device Corp.
Railway & Industrial Eng. Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

**Pulverized Fuel Equipment**
Combustion Engineering Corp.

**Pumps**
*Boiler Feed*
Ingersoll-Rand Co.
Lecourtenay Co.
*Centrifugal*
Allis-Chalmers Mfg. Co.
Chicago Pump Co.
De Laval Steam Turbine Co.
Lecourtenay Co.
Manistee Iron Works
Pelton Water Wheel Co.
Terry Steam Turbine Co.
*Power*
Lecourtenay Co.
*Reciprocating*
Allis-Chalmers Mfg. Co.
Terry Steam Turbine Co.

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Cutler-Hammer Mfg. Co.
General Electric Co.
General Radio Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

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Johns-Pratt Co.

**Rail Bonds**
American Steel & Wire Co.
Ohio Brass Co.

**Ranges**
Westinghouse Elec. & Mfg. Co.

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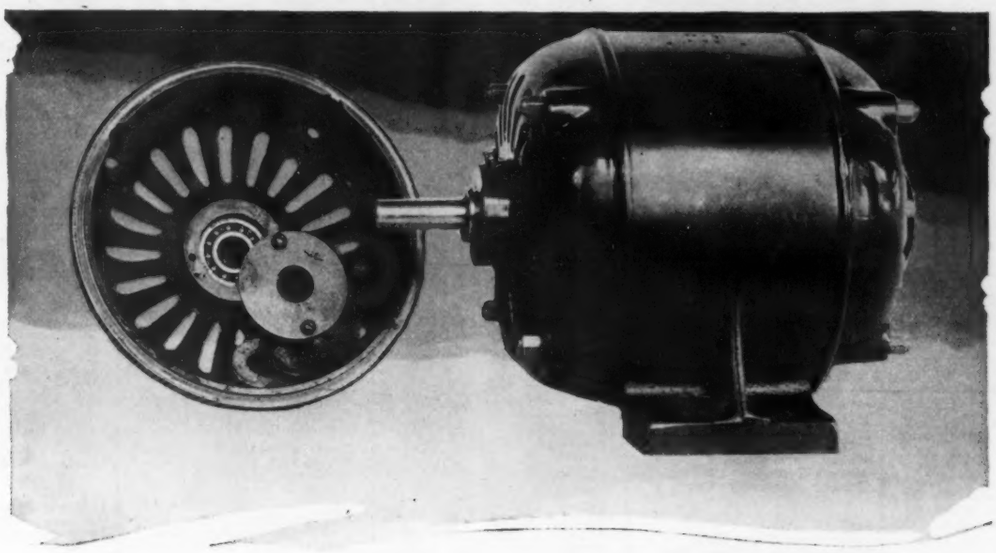

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Westinghouse Elec. & Mfg. Co.

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Biddle, James G.
Cutler-Hammer Mfg. Co.
General Electric Co.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.
*Motor Speed Regulating*
Ward Leonard Elec. Co.
*Starting and Controlling*
Ward Leonard Elec. Co.

**Rods**
*Brass, Copper and Bronze*
American Brass Co.
American Copper Prod. Co.

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Master Rule Co.
*Cylindrical*
Small Calculaton Co.

**Searchlights**
General Electric Co.
*Portable*
Portlight Light Co.

**Second-Hand Apparatus (See Searchlight Section)**
Archer & Baldwin
Ashley, Allen
Belyea Co.
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Gregory Electric Co.
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Hemphill & Co., J. L.
Jawitz Elec. Co.
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Motor Equipment Co.
Motor Repair & Mfg. Co.
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Power Machy. Ex.
Ross Power Equip. Co.
Roswell, C. M.
Sachsenmaier Co., George
Scheinert Co., R.
Surety Motor Bonding Co.
Tippins & Sprengle
Triangle Elec. & Machy. Exchange, Inc.
Zelnicker, in St. Louis

**Separators**
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Mansfield Sheet & Tin Plate Co.
Newport Rolling Mill Co.
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*Metal*
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**Silent Chain Drives**
Morse Chain Co.

**Slack Pullers**
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**Slate**
Portland-Monson Slate Co.

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General Electric Co.

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Westinghouse Elec. & Mfg. Co.

**Soldering Flux**
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**Springs**
American Steel & Wire Co.

**Sprockets, Silent Chain**
Morse Chain Co.

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*Metal*
Prat-Daniel Corp.

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**Staples**
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Blake Signal & Mfg. Co.

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Condit Elec'l Mfg. Co.
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General Electric Co.
Sundh Electric Co.
Ward Leonard Elec. Co.
Westinghouse Elec. & Mfg. Co.

**Steam Specialties**
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Power Specialty Co.

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American Engr. Co.
Babcock & Wilcox Co.
Combustion Engr. Corp.
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Riley Stoker Co., Sanford
Westinghouse Elec. & Mfg. Co.
*Mechanical*
American Engr. Co.
Combustion Engr. Corp.
Westinghouse Elec. & Mfg. Co.

**Stoves (See Ranges)**

**Strainers**
*Oil*
Bethlehem Shipbuilding Corp.

**Structural Steel**
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Pacific Coast Steel Co.

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Railway & Industrial Eng. Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

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Power Specialty Co.
Superheater Co.

**Supplies (Electric Railway)**
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Western Electric Co.
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**Switchboard Supplies**
Electric Power Equip. Corp.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

**Switchboards**
Allis-Chalmers Mfg. Co.
Anderson Mfg. Co. A. & J. M.
Condit Elec'l Mfg. Co.
General Electric Co.
Johns-Manville, Inc.
Westinghouse Elec. & Mfg. Co.

**Switches**
*Air Brake and Pole Top*
Condit Elec'l Mfg. Co.
Delta-Star Elec. Co.
Electric Power Equip. Corp.
Elec'l Engineers Equip. Co.
General Electric Co.
Hi-Voltage Equip. Co.
Railway & Industrial Engr. Co.
Schweitzer & Conrad, Inc.
*Disconnecting*
Anderson Mfg. Co., A. & J. M.
Champion Switch Co.
Delta-Star Elec. Co.
Electric Power Equip. Corp.
Electrical Development & Mach. Co.
General Electric Co.
Matthews Corp., W. N.
Schweitzer & Conrad, Inc.
Trumbull Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.
*Float*
Cutler-Hammer Mfg. Co.
Electric Service Supplies Co.
General Electric Co.
Ohio Brass Co.
Sundh Brass Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
*Fuse*
General Electric Co.
Matthews Corp., W. N.
Metropolitan Device Corp.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
*Horn Gap*
Westinghouse Elec. & Mfg. Co.
*Instrument*
Westinghouse Elec. & Mfg. Co.
*Knife*
Condit Elec'l Mfg. Co.
Cutter Company
General Electric Co.
Trumbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
*Meter and Service Entrance*
Palmer Elec. & Mfg. Co.
*Oil*
Condit Elec'l Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
*Remote Control*
Anderson Mfg. Co., A. & J. M.
Cutler-Hammer Mfg. Co.
General Electric Co.
Payne Dean, Ltd.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.
*Safety*
Johns-Pratt Co.
*Safety Enclosed*
General Electric Co.
Turnbull Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
*Series*
Cutler-Hammer Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.
*Snap and Push Button*
Cutler-Hammer Mfg. Co.
G & W Elec. Spec. Co.
General Electric Co.
Western Electric Co.
*Time*
Anderson Mfg. Co., A. & J. M.
General Electric Co.
Paragon Electric Co.
Westinghouse Elec. & Mfg. Co.

**Synchroscopes**
Roller-Smith Co.
General Electric Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.
Weston Elec'l Inst. Co.

**Tachometers**
Biddle-Smith Co.
Zernickow, O.

**Tanks**
Riter-Conley Co.
*Surge*
Larner Engineering Co.

**Tape, Friction**
Johns-Manville, Inc.

**Tape, Rubber**
Johns-Manville, Inc.

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**Testing Apparatus**
American Transformer Co.
Biddle, James G.
General Electric Co.
Roller-Smith Co.
Westinghouse Elec. & Mfg. Co.

**Theatre Dimmers**
Cutler-Hammer Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

**Thread, Braider**
Worcester Bleach & Dye Works Co.

**Ties**
Naugle Pole & Tie Co.

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Westinghouse Elec. & Mfg. Co.

**Tools**
*Construction*
Leach Co.
*Cutter*
Koch, Paul W.
*Portable Elec.*
Leffel & Sons Co., James

**Tools, Linemen's (See Linemen's Supplies & Tools)**

**Towers**
*Radio*
Milliken Bros. Mfg. Co.
Pacific Coast Steel Co.
Riter-Conley Co.
*Transmission*
Aermotor Co.
American Bridge Co.
Archbold-Brady Co.
Bates Exp. Steel Trus. Co.
Milliken Bros. Mfg. Co.
Pacific Coast Steel Co.
Riter-Conley Co.
Truscon Steel Co.

**Traffic Lights**
Elkhart Foundry & Mach. Co.

**Transformers**
Allis-Chalmers Mfg. Co.
American Transformer Co.
General Electric Co.
Kuhlman Electric Co.
Moloney Elec. Co.
Packard Electric Co.
Pittsburgh Transformer Co.
Westinghouse Elec. & Mfg. Co.
*Distribution and Power*
Westinghouse Elec. & Mfg. Co.
*Instrument*
Roller-Smith, Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec'l Inst. Co.

**Transformers, Bell Ringing**
General Electric Co.
Metropolitan Devices Corp.
Packard Electric Co.
Westinghouse Elec. & Mfg. Co.

**Transmission, Silent Chain**
Morse Chain Co.

**Traps, Steam**
Johns-Manville, Inc.

**Tubes**
*Brass, Copper and Bronze*
American Brass Co.

**Turbines**
*Hydraulic*
Allis-Chalmers Mfg. Co.
Cramp & Sons, Wm. J.
Leffel & Co., James
Pelton Water Wheel Co.
Smith Co., S. Morgan
*Steam*
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.
General Electric Co.
Ridgway Dynamo & Eng. Co.
Sturtevant Co., B. F.
Terry Steam Turbine Co.
Westinghouse Elec. & Mfg. Co.

**Turbo-Generators**
General Electric Co.
Terry Steam Turbine Co.
Westinghouse Elec. & Mfg. Co.

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**Washers**
Mass. Machine Shop

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Pelton Water Wheel Co.

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**Water Wheel Governors**
Pelton Water Wheel Co.

**Water Wheel Governors**
Lombard Governor Co.
Woodward Governor Co.

**Wattmeters, Watt Hour Meters (See Instruments)**

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Elkhart Rubber Co.

**Welder**
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General Electric Co.
Ohio Brass Co.
Westinghouse Elec. & Mfg. Co.
*Portable*
Ohio Brass Co.

**Welding Apparatus**
Ohio Brass Co.

**Welding Machines**
General Electric Co.
Westinghouse Elec. & Mfg Co.

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*Aluminum*
Aluminum Co. of America
*Auto*
Indiana Rubber & Ins. Wire Co.
*Bare and Insulated*
Standard Underground Cable Co.
*Bare Copper*
American Brass Co.
American Ins. Wire & Cable Co.
American Steel & Wire Co.
Anaconda Copper Mining Co.
Illinois Wire & Cable Co.
*Enameled*
Maring Wire Co.
*Magnet*
American Enameled Magnet Wire Co.
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Roebling Sons Co., J. A.
*Magnet (Enameled)*
Dudlo Mfg. Co.
*Miscellaneous*
Belden Mfg. Co.
*Resistance*
Driver-Harris Co.
*Rubber Covered and Waterproof*
American Ins. Wire & Cable Co.
Belden Mfg. Co.
Illinois Wire & Cable Co.
Indiana Rub. & Ins. Wire Co.
Okonite Co., The
Packard Electric Co.
Roebling's Sons Co., J. A.
Safety Ins. Wire & Cable Co.
Simplex Wire & Cable Co.
Western Electric Co.
*Steel*
American Steel & Wire Co.
*Trolley*
American Copper Prod. Co.
*Underground (Cable)*
Roebling Sons Co., J. A.
Western Electric Co.
*Varnished Cambric*
Okonite Co., The

**Wireless Apparatus**
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Westinghouse Elec. & Mfg. Co.

**X-Ray Apparatus**
Anderson Mfg. Co., A. & J. M.

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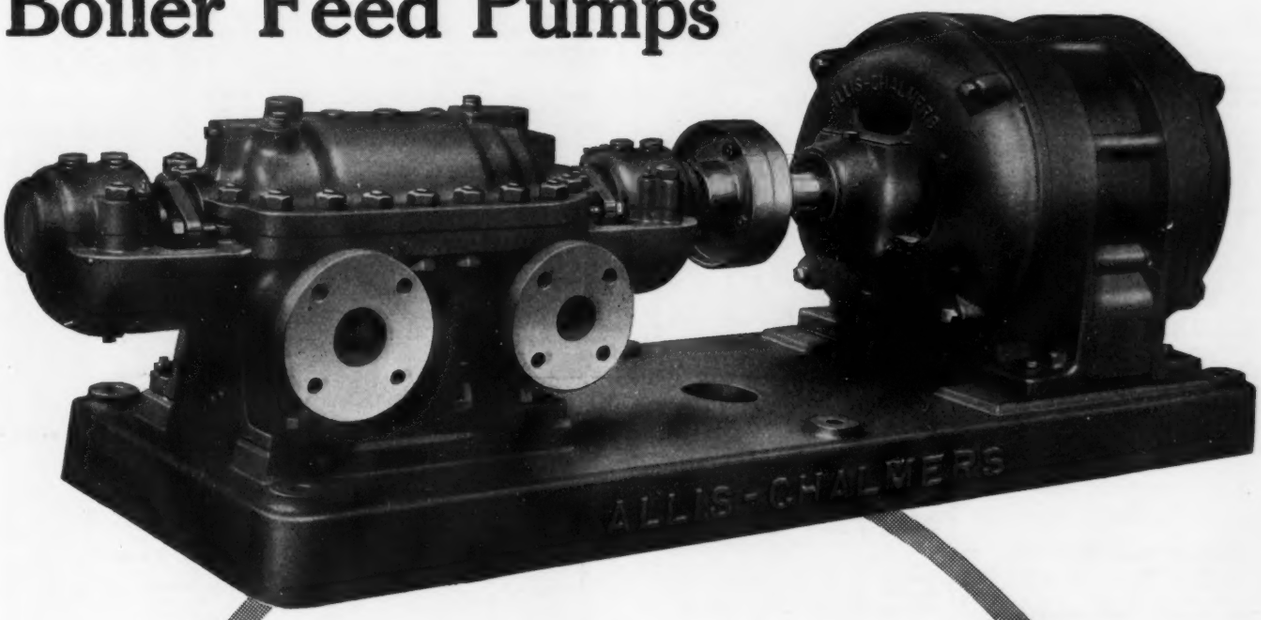


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This means one Company selects and stands back of a complete unit of its own manufacture consisting of both pump and drive. The pump illustrated is the smallest size we have recently developed for feeding boilers of from seven hundred fifty to sixteen hundred boiler horsepower. It is built with the same care and along the same lines as our well known boiler feed pumps of larger sizes. Your inquiry will bring you our recommendations for the best Centrifugal Pumping Unit for boiler feed or other service.

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

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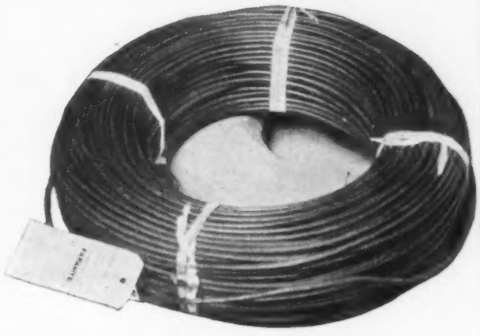

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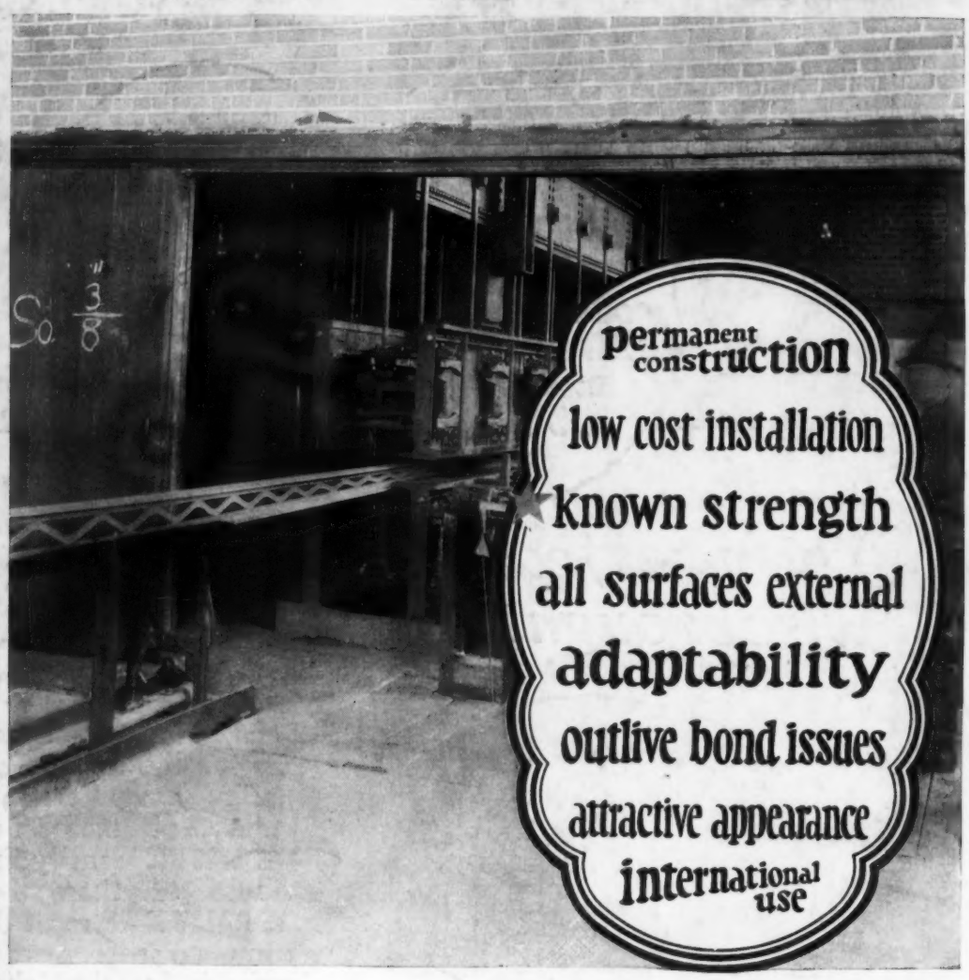


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